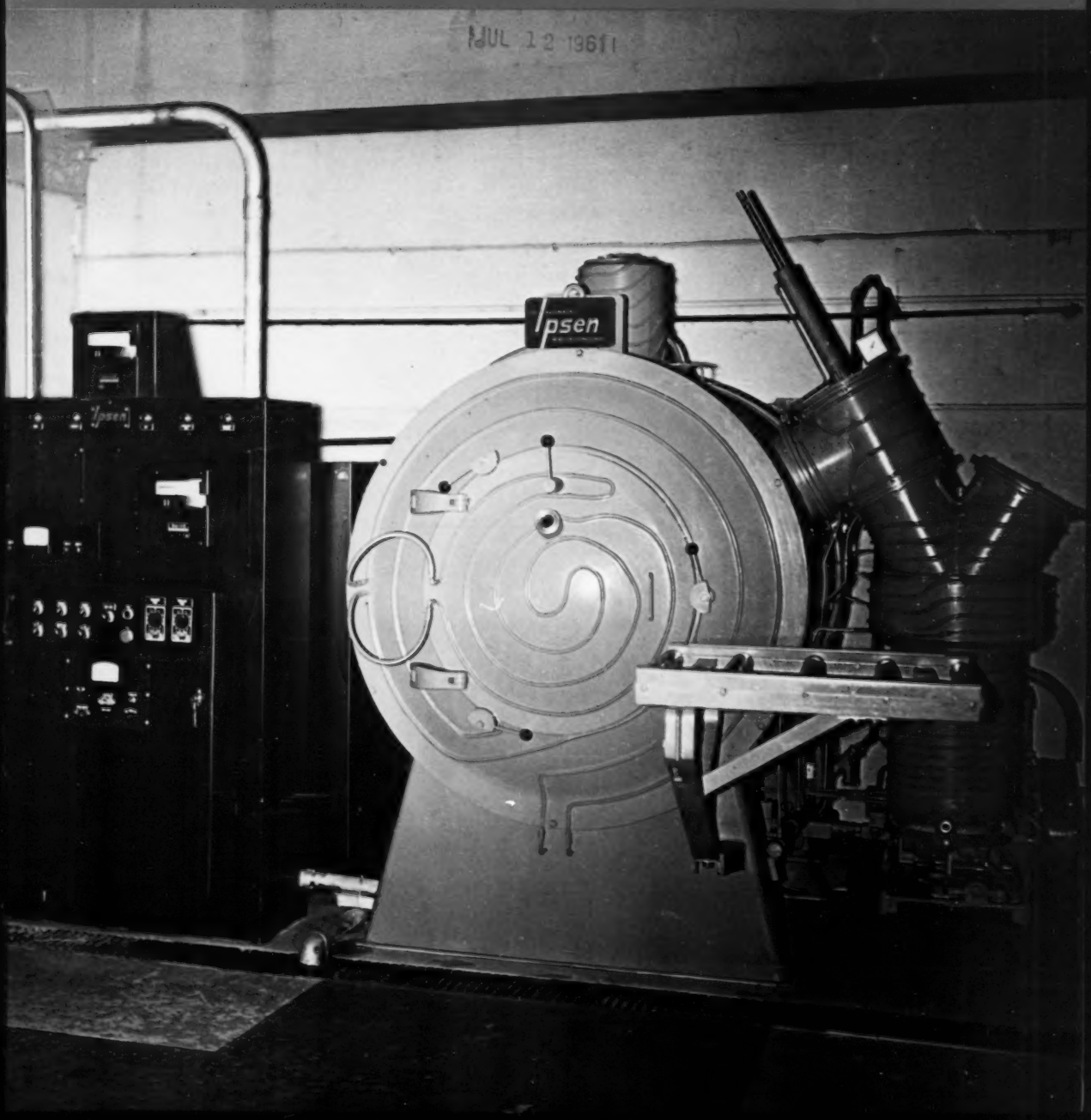
Metal Treating

JUNE
JULY 1961
Vol. 12
#3

THE *ONLY* MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

JUL 12 1961



Easy as one, two, three — four... getting the right Sunoco quenching oil

Just determine your requirements. Then select from one of four Sunoco quenching oils.

To keep coolers cleaner longer, use Sun Quenching Oil Light, a "job proved," all-purpose oil with the added benefit of natural detergency.

For fast cooling rates, minimum distortion, and deeper hardnesses, use Sunquench 1070.

For ideal bright quenching, use Sun Quenching Oil 11, a premium-quality, paraffinic quenching oil with a high flash point.

For marquenching work up to 400 F, use Sun Marquenching Oils. They are inhibited paraffinic oils with high thermal stability that give long service life.

Your Sun representative can analyze your quenching-oil needs. You may be over-spending or not getting the quality you should. Call your local Sun office, or write today to SUN OIL COMPANY, Dept. MR-6, Phila. 3, Pa. In Canada: Sun Oil Company Limited, Toronto and Montreal.

SUNOCO®

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINE

For further information circle No. 58

Metal Treating

THE ONLY MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

STAFF

Editor — C. E. HERINGTON
Associate Editor — THOMAS A. DICKINSON
Business Manager — ANN M. ROARKE
Production Manager — A. L. WALTERS

PUBLICATION COMMITTEE

HORACE C. KNERR, Chairman
Metlab Company,
Philadelphia, Pennsylvania

LLOYD G. FIELD
Greenman Steel Treating Company,
Worcester, Massachusetts

FRED HEINZELMAN, JR.
Fred Heinzelman & Sons, Inc.
Carlstadt, New Jersey

NORMAN HODGSON
Alfred Heller Heat Treating Co., Inc.
New York, N. Y.

MICHAEL KOBER
Commercial Metal Treating, Inc.
Bridgeport, Connecticut

CHARLES R. WEIR
Commonwealth Industries, Inc.
Detroit, Michigan

JOHN R. RIES
Lakeside Steel Improvement Co.
Cleveland, Ohio

SALES REPRESENTATIVES

California

KEITH H. EVANS
and ASSOCIATES
3723 Wilshire Boulevard
Los Angeles 5, California
DUnkirk 8-2981

Mid-West

ALFRED W. COLLIER
320 Waukegan Rd.
Glenview, Illinois
PArk 9-0700

Eastern

FREDERIC W. PECK
97 Thornton Street
Hamden 14, Connecticut
CHestnut 8-2233

Boston Office

318 Little Building
Boston 16, Mass.
LIberty 2-7610

The Metal Treating Institute, Officers 1960-61

JOHN H. RIES, President
Lakeside Steel Improvement Co.
Cleveland, Ohio

C. F. DOMINY, Vice-President
Superior Heat Treating Co.
Fort Worth, Texas

LLOYD G. FIELD, Treasurer
Greenman Steel Treating Co.
Worcester, Massachusetts

H. R. HERINGTON, Executive Secretary
Box 448
Rye, New York

CONTENTS

FEATURES

Vacuum Heat Treating
by Harold N. Ipsen 11

Heat Treating of a Special Stainless Alloy
A Special Report 16

1961 Western Metal Show Draws Unprecedented Crowds 19

Furnace Atmosphere Analyzer-Controller Yields Remarkable Heat Treating Accuracy 21

DEPARTMENTS

What Would You Do? 26

About People 28

News To Heat Treaters 33

Manufacturers' Literature 40

Heat Treating Case Histories 42

Equipment and Materials Directory 46

Index to Advertisers ... 48

• • •

Indexed in Engineering Index

JUNE-JULY 1961 — BPA — VOL. XII No. 3

Member of Business Publications Audit of Circulation, Inc.

The presentation of editorial material in "Metal Treating" should not be interpreted as either an endorsement or recommendation by the Metal Treating Institute of the statements set forth.

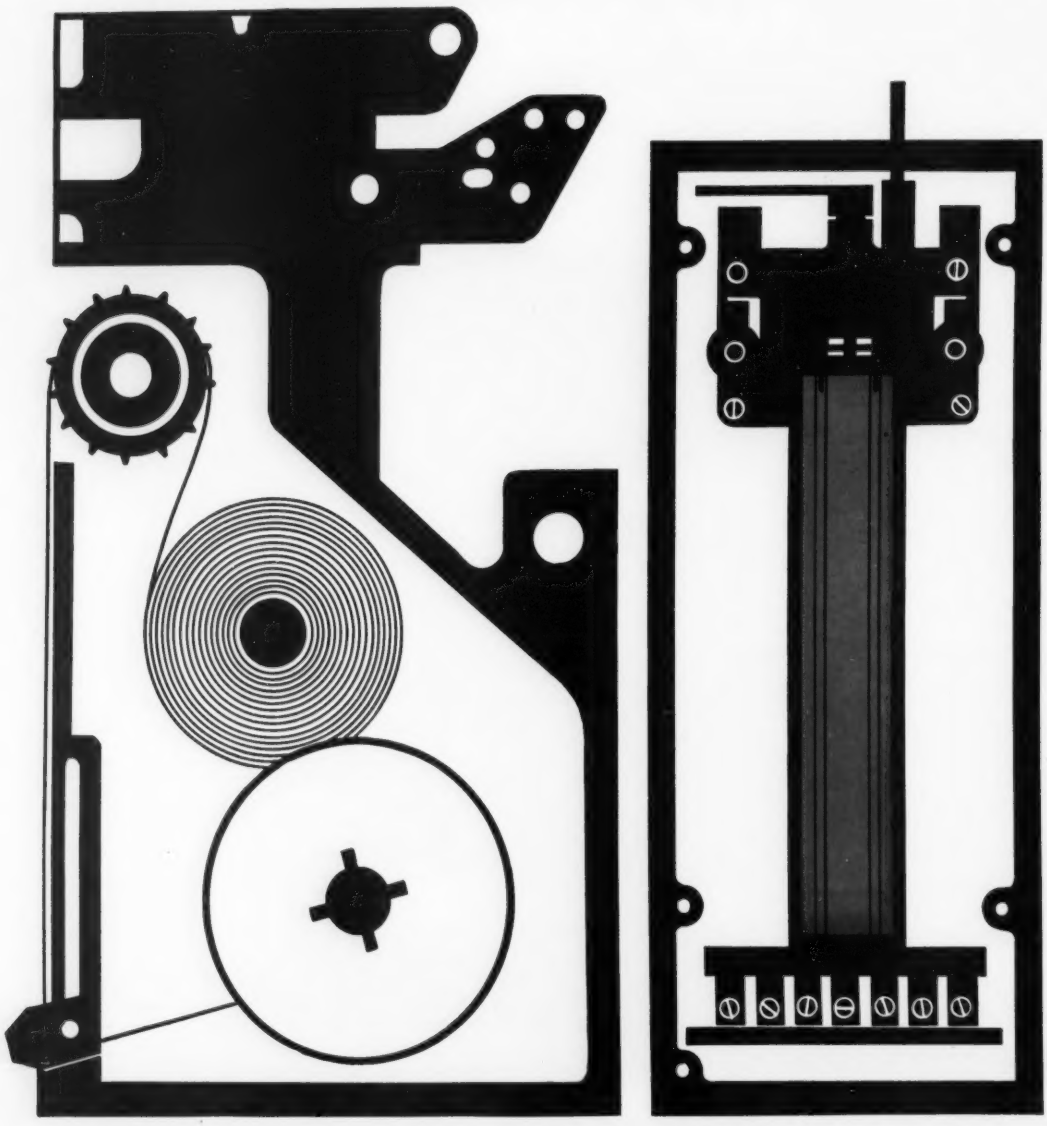
Published bimonthly by the Metal Treating Institute, Box 448, Rye, New York.
Send all correspondence to—Metal Treating Magazine, 900 North Federal Highway, Pompano Beach, Florida.
Send all plates to—Ashcraft, Inc., 816 Locust St., Kansas City 6, Missouri.

Copyright 1961 by the Metal Treating Institute. All rights reserved.

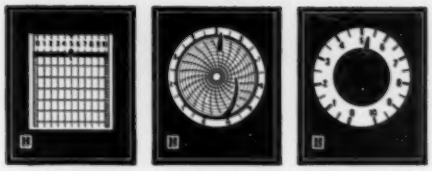
About Our Cover

Ipsen Industries' giant VFC-300 unit on this month's cover gives a portent of even more changes in the metal treating industry. The color photograph was taken at the Commercial Metal Treating, Inc. plant in Bridgeport, Conn. See page 11.

ALL-NEW *ElectroniK 17* POTENTIOMETERS



NO SLIDEWIRE, NO SLIDEWIRE PROBLEMS. The unique *STRANDUCER* rebalancing element, an innovation in potentiometer design, replaces the conventional slidewire. It works on the proven strain gage principle and consists of four looped wire strands which form the resistance legs of a Wheatstone bridge. Both *STRANDUCER* and pen carriage are linked to the potentiometer balancing motor. A change in electrical input causes the balancing motor to change the tension—and electrical resistance—of the *STRANDUCER*. This in turn causes the balancing motor to rebalance the bridge, at the same time repositioning the instrument pen or pointer. The *STRANDUCER* is unaffected by corrosive atmospheres and has no contactors. It has unusually long life and infinite resolution and is unaffected when the instrument is subjected to ambient temperatures up to 130° F.



HAVE NO SLIDEWIRE, NO SLIDEWIRE PROBLEMS

Revolutionary STRANDUCER rebalancing element replaces slidewire . . . has unusually long life, infinite resolution*

Here is a totally new kind of potentiometer with a totally new kind of measuring system. The *STRANDUCER* rebalancing element replaces the slidewire, and sets a new high standard for potentiometer performance. The new *ElectroniK 17* potentiometers have a calibrated accuracy of ±0.25%.

In addition, modular construction makes *ElectroniK 17* instruments easiest of all potentiometers to operate, convert and maintain. Complete interchangeability of components cuts service downtime and minimizes spare parts stocking requirements for these advanced potentiometers.

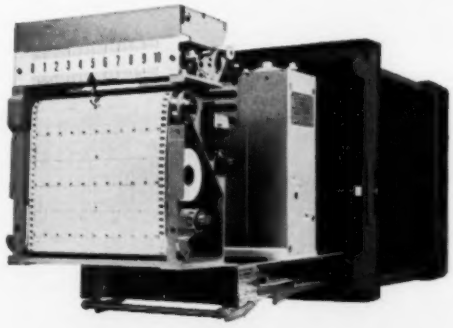
You can get *ElectroniK 17* instruments as strip or circular chart recorders or circular scale indicators. You can get electric contact control with up to 8 contacts. All control units are of convenient plug-in type.

ElectroniK 17 is one of the great advances in potentiometry, and you should have all the eye-opening facts about this new class of instruments. For complete details, call your nearby Honeywell field engineer, or write MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.—In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.

Honeywell

H HONEYWELL First in Control SINCE 1885

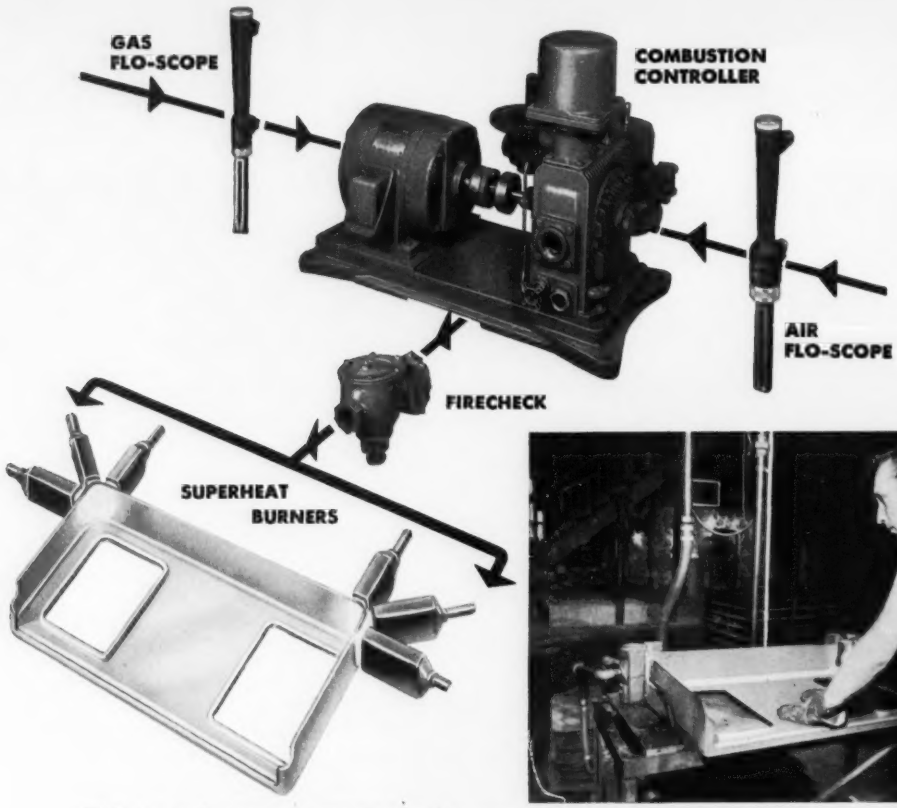
True modular construction saves you time, trouble, money. Three basic modules—case, display and drive—make up the *ElectroniK 17*. The case fits standard 19-inch relay racks. You can remove the door easily and without tools when converting from strip chart to circular chart or circular scale operation. You can pull out the chassis to the service position without tools, and without interrupting operation, or remove it completely. You can change chart speeds to ½ or 2 times basic speed (Standard chart speeds: 1, 2, 6, 10, or 60 inches per hour) by replacing quick-change drive gears. You change range and actuation simply by changing cards. Zener diode constant current supply eliminates battery problems. Up to 8 plug-in contact control modules provide for a wide variety of control possibilities.



HONEYWELL INTERNATIONAL Sales and Service offices in all principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

For further information circle No. 59

NEW SLANTS ON HEAT PROCESSING FROM SELAS



With this simple set-up, one man can anneal stove tops as fast as they come off the mechanical press. The top is simply placed in the jig and the Selas combustion system does the rest automatically. The three Superheat burners at each corner provide the right annealing temperature for the prescribed time, and at a fuel saving of 1/3 for Welbilt.

Selas Superheat Burners help double production, reduce fuel costs one-third at Welbilt Corporation

Welbilt Corporation, Maspeth, N. Y., formerly annealed the front corners of stove tops with an oxy-acetylene torch. Now with Selas Superheat burners and a Selas combustion system, using only commercial fuel gas and air—with no bottled oxygen—Welbilt has eliminated rejects and a production bottleneck. As each stove top is placed in a jig, the Superheat burners are brought instantly and automatically to heat to anneal the corners correctly and uniformly . . . *in one-half the time formerly required!*

To accomplish this efficiently, the Selas Superheat burners are supported by *other* components in the Selas combustion *system* including:

- *Combustion Controller*—by delivering gas-air mixture to burners at preset ratio and pressure, makes possible fast heating and close control. Completely automatic. (Bulletin CC-2)
- *Flo-Scopes®*—installed at the inlets to the Combustion Controller, measure rates of flow of gas and air and permit accurate determination of gas-air mixture ratios. (Bulletin FS)
- *Firecheck*—gives complete assurance of safety by automatically extinguishing any flashbacks that may occur. Factory Mutual approved. (Bulletin CS-2)

These combustion components are available *individually or as a complete combustion package.*

Selas Superheat Burners (Bulletin SB-1) can be installed in open arrangements . . . in-line . . . in circular rings . . . in spirals . . . individually . . . in opposed pairs. Also special Superheat designs can be custom-built to meet your specific needs. Available, too, are Selas Duradiant®, Refrak, Spear-Flame and Ribbon burners. Mr. P. Berg, General Industry Division, will be happy to furnish literature and information.

SELAS CORPORATION OF AMERICA
66 Dreshertown Road, Dresher, Pa.

SELAS

HEAT AND FLUID PROCESSING ENGINEERS
DEVELOPMENT / DESIGN / CONSTRUCTION

DURADIANT and FLO-SCOPE are registered trademarks of Selas Corporation of America.

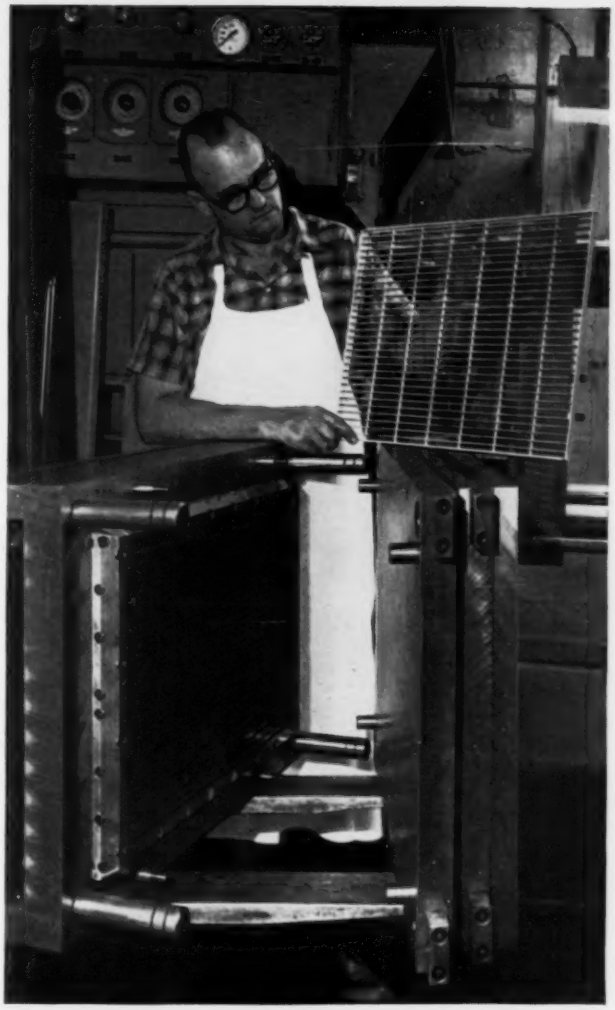
For further information circle No. 60

Tool Steel Topics

BETH EHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Plastic grille for air conditioner molded IN A BREEZE with Lustre-Die



This plastic grille for an air conditioner was molded at the rate of one per minute by Midwest Plastics Corporation, Wichita, Kansas. Using a die made of Lustre-Die tool steel, they produced a perfectly formed grille, with a high sheen. The grille measures 21½ x 15 in., and is ½ in. thick.

Why Lustre-Die is ideal for plastic molders

Lustre-Die tool steel is ideal for plastic molders because it can be put right to work, without the need for heat-treatment. It's easy to machine, and it polishes beautifully . . . making possible an eye-appealing sheen on finished plastic parts.

Lustre-Die is an electric furnace steel. It has a well-balanced basic analysis. By adding a special alloy fortification, which increases its depth of hardenability, its fine mechanical properties are further improved. Because Lustre-Die is heat-treated in the mill by means of oil-quenching and tempering, it comes ready for machining and polishing. It is also carefully controlled during manufacture to insure freedom from porosity.

You can always count on a fine molding job when you use Lustre-Die. But don't take our word for it. Put Lustre-Die to work in a trial run. Your Bethlehem tool steel distributor can supply you.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Watch Out for Abrasion Caused by Scale

When punch-press operators are occasionally unable to obtain the required sheet stock in the usual cold-finished form, they substitute hot-rolled stock. However, this causes the service life of the punches and dies to drop to one-half or one-third of normal, or less. This result is largely due to the abrasion of the scaled hot-rolled surface on the cutting edges of the tools. Determining whether such a substitution is economical depends upon the results which are expected, and the cost, of each individual job.

One frequently hears the question: "What can be done in tooling to avoid this decrease in production?"

When punches and dies are normally made from water-hardening carbon tool steel (W-1 or W-2), or from manganese oil-hardening steel (O-1), the shortening of tool life can be avoided by changing to a high-carbon high-chromium tool steel, such as Bethlehem Lehigh H (D-2). This change usually overcomes the disadvantage of using the hot-rolled scaled stock.

However, if high-carbon high-chromium grades are already being used, there is only one method by which an appreciable improvement can be realized—the use of special heat-treatment operations. Typical treatments are short-cycle hardening, and nitriding. Complete details regarding these types of treatment may be obtained by writing Bethlehem Steel Company, Bethlehem, Pa.

FIFTIETH

Park

1911 1961

ANNIVERSARY

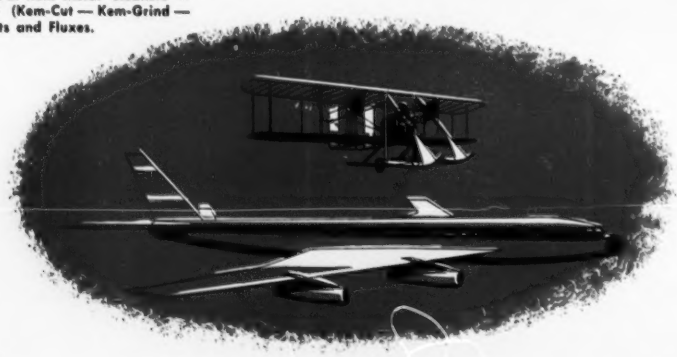
50 YEARS OF PROGRESS

Some things change drastically in fifty years; several are shown on this page. Other things change, too, but less noticeably — heat treatment of metals for example. Companies grow and prosper by helping to cause these changes and advancements. The Park Chemical Company started the manufacture of an improved carburizing compound for steel parts in 1911. Through the years they have developed better carburizing compounds, water-soluble and deep-case liquid carburizing salts, neutral salts and methods to maintain their neutrality, aluminum and magnesium brazing salts, quenching and tempering salts and oils, and protective coatings. With all their growth and change, one thing remains the same: a desire to help the heat treater with his problems.

Park's philosophy of service persists unaltered although greatly broadened in scope through greater laboratory facilities and more personnel. Why don't you take advantage of Park's fifty years experience in solving heat treating problems? Make a change for the better—get in touch with your local Park Representative or write us direct.

A COMPLETE LINE OF HEAT TREATING MATERIALS

Woodside Rapid Carburizers (Non-Burning — Charcoal-Coke — Specification) ● Park-Kase Liquid Carburizers ● Quenching and Tempering Oils ● Cyanide Mixtures ● Neutral Salt Baths ● High Speed Steel Hardening Salts ● Iso-Thermal Quenching and Tempering Salts ● Protective Coatings (No-Carb — No-Kase — No-Scale — No-Tride) ● Carbon Products (Charcoal-Crushed Coke-Pitch Coke-Lead Pot Carbon) ● Kold Grip Polishing Wheel Cement ● Par-Kem Metal Cleaners ● Cutting and Grinding Compounds (Kem-Cut — Kem-Grind — Blue Ice) ● Aluminum Brazing Salts and Fluxes.



Park

1911 1961

PARK CHEMICAL COMPANY 8074 Military Avenue, Detroit 4, Michigan

Ultrasonic transducer with water attachment is used to test brazing in big rocket engine component in Rocketdyne plant at Canoga Park, California.

Testing of brazed joints in the fast growing rocket and missile industry has long plagued some sections of the industry, especially when the parts were too large for standard immersing procedures. Here is how one firm solved the problem.

AN UNUSUAL TEST FOR BRAZING

A TECHNIQUE that permits the satisfactory testing of brazed joints in rocket engine components which have contoured surfaces and are too large to be immersed in available water tanks is now being employed by Rocketdyne, a division of North American Aviation, Inc., Canoga Park, California.

It is difficult to get ultrasound into parts of this type because they cannot be properly contacted by the vibrating face of a piezolectric transducer, and because a very thin layer of ordinary air cannot be penetrated by high-frequency sound waves.

Since fluids are excellent transmission media for ultrasonic energy, and since water is the least expensive liquid for most practical purposes, parts with irregular or contoured surfaces are usually immersed in water tanks during ultrasonic test work.

Rocketdyne has been able to eliminate the need for an ultra-large and costly water tank. Currently in use is a transducer which has a special spigot and rubber hose attached to maintain a steady stream of water between the transducer's face and a workpiece.

Air bubbles in the water no doubt prevent the transmission of some ultrasound, but not enough to create echoes which might make it hard to distinguish energy reflected by brazing flaws.

Water is presently being allowed to escape into a conventional drain, but it could be recovered for further use if costs made water reclamation necessary.

• • •

Fast Cool....2100° to 500° in 14 minutes!

with a 300 lb. load,

Ipsen VFC-300
Automatic Vacuum
Heat-Treating Unit.

— and at

½ THE OPERATING COST OF A HYDROGEN FURNACE!

For complete data and specifications,
Write Ipsen — or contact your nearest Ipsen representative.

AUTOMATIC Ipsen HEAT TREATING UNITS

IPSEN INDUSTRIES, INC. • DEPT. 733 • P.O. BOX 500 • ROCKFORD, ILLINOIS

For further information circle No. 90

Bright and clean—these steel parts have just come from a Voluta 921 quench bath.

BULLETIN:

Shell tells how new Voluta 921 cuts quench time, fights surface-spoiling spots and stains

Shell Research has developed a quench oil with a unique combination of properties: it cools quickly and assures a bright surface.

Read how Shell Voluta® 921 Quenching Oil can help eliminate staining problems, reduce rejects, and give you better brightness outside, better hardness inside.

SHELL's new Voluta 921 is a premium quench oil that helps assure metal surface brightness and maximum hardness without warping, cracking or distortion.

Brightness or hardness?

In the past, quench oils have been able to provide either "good looks" or toughness.

New Voluta 921 quenching oil gives both—and with remarkable speed.

How does Shell's Voluta 921 deliver these *two* benefits while most other quench oils can supply only one?

New formula does it

The high level of surface brightness comes from a special formula developed and perfected at Shell's research laboratory in Wood River, Illinois.

The very rapid quenching qualities of Voluta 921 come from the same advanced formula *and* from Shell's selected base oil stocks.

When the work emerges from a Voluta 921 bath, it is bright and clean.

Hardness will be deep and uniform.

Proved in quality shops

Some of the most impressive facts regarding Voluta 921 came from Commercial Metal Treating, Inc., of Bridgeport, Connecticut.

Here the new oil was use-tested for nine months on everything from top-secret military parts to high-finish belt buckles.

It helped eliminate rejects caused by spotting and staining. It produced uniformly excellent results throughout the shop. Its high resistance to oxidation and sludging prolonged the usable life of the oil.

Commercial Metal Treating's President, Mr. Michael Kober, reports that his plant has *standardized on Voluta 921—uses nothing else.*

Shell's Voluta 921 can help improve metal hardness and heat-treating efficiency in your plant, too.

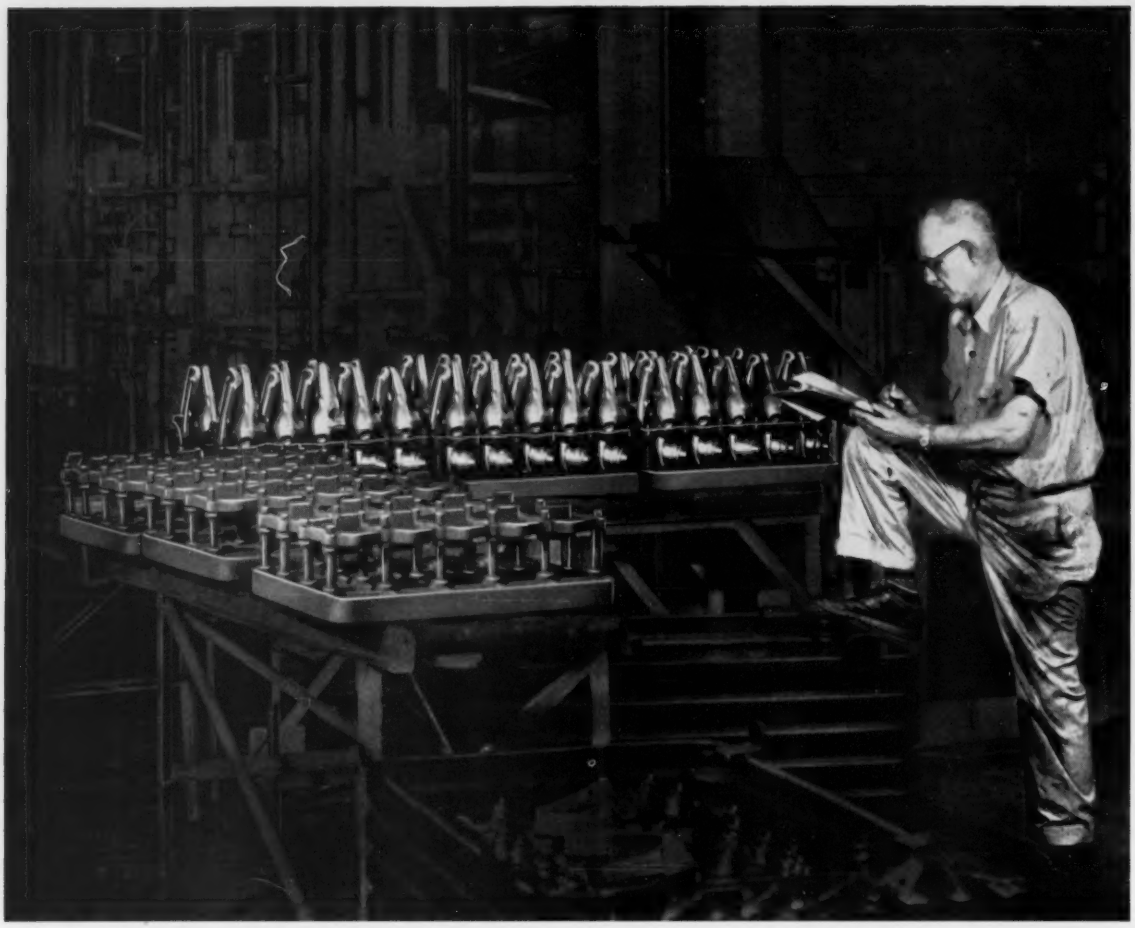
Call your Shell Representative

Ask your Shell Industrial Products Representative for all the facts on new Voluta Oil 921. Or write: Shell Oil Company, 50 West 50th Street, New York 20, N.Y.

SHELL

A BULLETIN FROM SHELL
—where 1,997 scientists are working to provide better products for industry

For further information circle No. 91



Security Engineering, a division of Dresser Industries, Inc., manufacturers of rock bits and tools for the oil and mining industries, depends upon "heat-beating" Cast HU alloy trays to combat years of punishment inside carburizing furnaces.

Cast HU high-nickel alloy carburizing trays... Still on the job after 3 fiery years at 1700°F.

No "vacations" needed for these heat-treating trays used by The Security Engineering Division of Dresser Industries, Dallas, Texas. They're constantly fighting carburizing atmospheres that soon "retire" thin-sectioned trays of lower alloyed materials. Not even the brutal punishment of repeated thermal shock during oil quenching stops these trays. They're made from Type HU* cast high-nickel alloy. (39% Nickel-19% chromium).

3 Years at 1700°F... 24 hours a day, these trays take on incandescent temperatures. Yet they don't scale or flake—thanks to Type HU alloy's superior resistance to carburization (and freedom from sigma phase embrittlement).

Casting cuts initial cost too. Right from the start, cast HU alloy trays save you money. They're easy to make—cast in the design that suits your needs.

Surface film stability—resistance to oxidizing and reducing atmospheres—is an important property of Type HU alloy. So is high creep strength and useful ductility up to 2000°F. And Type HU alloy is one of a family of high-nickel alloys especially effective in heat-treating applications. They've got extra long lives in the 1200-2200°F range.

If you have design problems involving high pressures, high temperatures, and corrosive conditions, find out more about Type HU and the other "heat-beating" alloys in the 72-page booklet, *Heat Resistant Castings, Corrosion Resistant Castings . . . Their Engineering Properties and Applications.* It's a reference book made for your files. Write for your free copy of A-266.

*A.C.I. designation

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street INCO New York 5, N. Y.

INCO NICKEL

NICKEL MAKES CASTINGS PERFORM BETTER LONGER

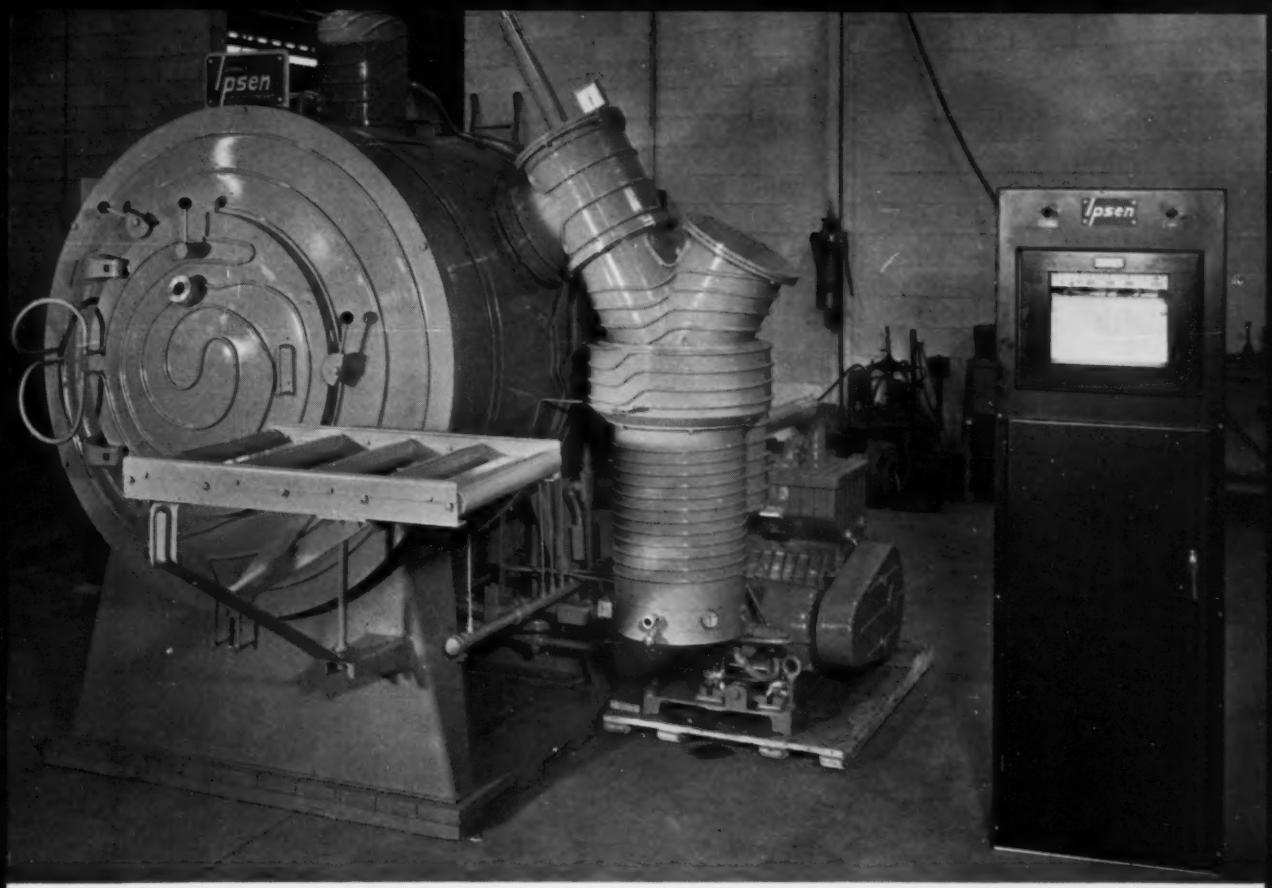


FIG. 1. VFC-300 unit displayed by Ipsen at the 1960 Metal Show in Philadelphia.

VACUUM HEAT TREATING

A Progress Report

by

HAROLD N. IPSEN, President

Ipsen Industries, Inc.

A relatively new vacuum processing method in heat treatment of metals is achieving a practical status and increasing acceptance. This report details the results of recent research.

TWO MAJOR REASONS make vacuum processing an effective means of heat treatment: 1. The formation of unwanted compounds is prevented by utilizing the protective features of the vacuum, 2. Dissociate compounds which have already been formed are dispelled by the degassing features of the vacuum. With these facts in mind, consideration has been given to vacuum as a means of production heat treating and brazing for stainless and high temperature alloy parts requiring temperatures of 1750 F. and higher. Parts treated in vacuum furnaces operating on a laboratory scale have shown metallurgical results that equal and often better those processed by other heat treating methods including salt, generated atmospheres, hydrogen, nitrogen, argon, etc. Recent developments show that vacuum units are more economical to heat, they are simpler to control and safer to operate.

Outside of some companies engaged in government and defense work, little production vacuum heat treating equipment has been in-

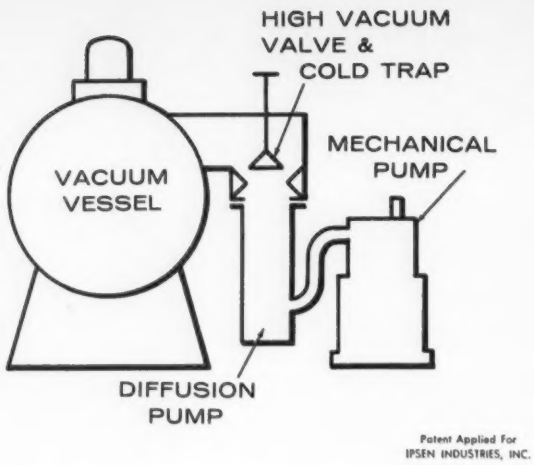


FIG. 2. Schematic of Ipsen pumping system.

stalled to date. The equipment offered has been custom designed and expensive, the vacuum pumping systems have been complicated, and the radiant shields have made heating inefficient. However, an insulated vacuum furnace of the cold wall type has now been built that will produce superior metallurgical results on a production basis and at costs far less than had been considered possible.

From a metallurgical standpoint, vacuum heat treating has many advantages over atmosphere heat treating. With controlled atmosphere heat treating, results depend chiefly upon the laws of physical chemistry, while vacuum technology depends upon the laws of physics. Dissociation pressures of compounds are substituted for chemical reactions between elements and gaseous compounds.

Vacuum System Speeds Cycle

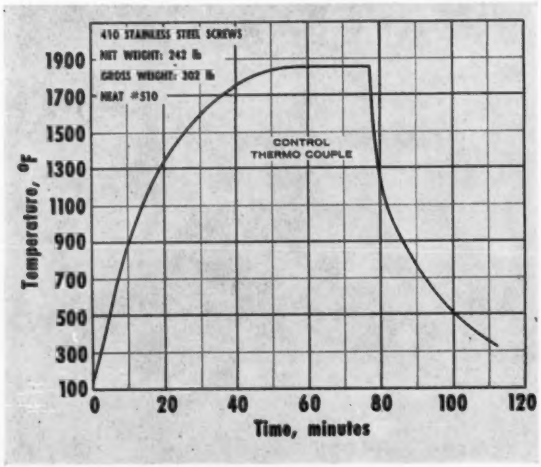


FIG. 3. Graph showing the temperature and time chart.

For example, when stainless steel is treated in a hydrogen atmosphere, the hydrogen will reduce oxides on the surface but will have no effect on other gases which may be present in the immediate surface of the material. However, if stainless steel is heat treated in a vacuum furnace, the surface oxides will be removed, by dissociation of the oxide, along with the nitrogen, hydrogen, and dissolved oxygen. This will improve mechanical properties. During the past decade it has been found that vacuum melted steel and alloys have certain properties superior to air melted metals. On the basis of these findings it would seem advantageous when heat treating these steels and alloys that it be done in a vacuum furnace to prevent the formation of surface oxides or other contaminants. The risk involved in heat treating stainless, air hardened tool steel, precipitation hardening austenitic steel, titanium, columbium, tantalum, zirconium, or other like metals, is very small in a vacuum furnace when compared to any other processing method. There is no danger in a vacuum of carbonitriding, carburizing, decarburizing, nitriding, siliconizing, sulfurizing, or of forming hydrogen embrittlement. Since vacuum permits the removal of contaminants, including oxide films, work emerges exceptionally bright. There is also a minimum of distortion and improved mechanical properties usually result. In practically every case, the metallurgical result is superior to other types of processing. From a metallographic standpoint, there is no difference in the structure obtained from a hydrogen heat treatment than from vacuum heat treatment, but the impact strength and ductility of the vacuum heat treated stainless may be considerably higher than that of the hydrogen heat treated material. Therefore, the only definite way to determine the advantages of vacuum heat treated material over the hydrogen or atmosphere treated material is generally from a destructive test. A typical example is shown in table 1.

TABLE 1. A Comparison of Results From Vacuum Treated vs. Hydrogen Treated AISI 410 Stainless Steel Screws

	Vacuum Treatment	Hydrogen Treatment
Hardness	41-43 Rc	39-41 Rc
Torque	200-220 in. lb.	160-180 in. lb.
Bend	25-35 degrees	16-18 degrees

There are a few cases where heats of material might show no increase in properties vacuum heat treated over those hydrogen heat treated, but these are in the minority. Nearly every commercial stainless will have small amounts of dissolved gas.

A typical vacuum automatic batch type heat treating unit is illustrated by the VFC-300 unit, (Fig. 1), a recent installation of which is shown on the front cover of this issue. It consists of a vacuum tight shell, an electric heated roller hearth furnace, a cooling fan and a simple pumping system. The vacuum chamber has dished end covers bolted to a cylindrical water-

traced shell sealed with rubber "O" rings. A hinged and dished charging door, sealed with a rubber "square" ring, is superimposed on the front cover. Electric power lead-ins, a sight port, a thermocouple junction, and cooling gas inlet are the only other entrances into the vacuum shell. The leak rate of the VFC-300 is less than 50 microns Hg per hour. At this rate it should require two years to leak from one micron Hg to atmospheric pressure. Copper cooling coils are joined to all parts of the vacuum shell.

The VFC-300 furnace has an input of 75 kw., and a 24 in. by 36 in. hearth with 12 in. work clearance. The furnace is heated by low voltage graphite tubular elements placed above and below the work chamber. The 22 in. by 34 in. work tray is supported on two in. diameter ceramic tubes which are free rolling during loading and unloading operations. Wheels attached to the outside of the furnace frame rest on rails welded to the inside of the vacuum shell. These support the entire furnace. The furnace can be rolled out for servicing and inspection.

The furnace frame is made of steel plate perforated to allow outgassing. The unit has lightweight insulation with inner walls of high temperature alloy sheets. Rectangular openings in it at top and bottom allow gas to pass during cooling cycles. A duct surrounds the top insulating pad and fastens to the furnace frame, forming the gas inlet to the fan. The fan is only used for fast cooling. After gas has been introduced, and during a cooling cycle, the 3 h.p. driven fan forces the cooling gas down the inside finned wall of the vacuum shell, up past the bottom opening in the furnace, and through the work at a rate of approximately 2,500 ft. per minute.

In the Ipsen vacuum system, gases and vapors are removed from the sealed vessel by a simple pumping system. This system (Fig. 2) consists of a gas ballast rotary piston mechanical vacuum pump coupled with a three stage oil vapor diffusion pump. As used on the VFC-300 unit, the mechanical vacuum pump has a 100 c.f.m. capacity and is driven by a five h.p. motor. The 16 in. oil vapor diffusion pump has a 7,000 c.f.m. capacity using a 4,500 watt heater. These pumps reach the vessel through a large fine vacuum pipe containing a combination high vacuum valve and a cold trap.

Two vacuum gauges, an Ipsen Vacutronik gauge and a Bourdon Tube gauge are used. The Vacutronik gauge is used to record and control the operating pressure within the vessel. This provides a safety factor through its ability to cut off power to the heating elements during any pressure rise over 1,000 microns Hg or at any preset pressure.

The unit is completely automatic in operation. After the load is placed in the furnace and the door is sealed, the temperature and the time "at heat" are set. When the start button is depressed, the furnace goes through its automatic sequence.

First, the furnace is automatically evacuated to the desired vacuum pressure. The charge then is heated and soaked at the desired temperature (Fig. 3). Since there is no gas present in the vacuum furnace, there can be no gaseous reactions. In fact, vacuum heat treatment extracts many surface contaminants and processing lubricants which would be difficult and costly to remove by any other method. During the

FIG. 4. Sample hydrogen furnace cost record sheet used at Ipsen.

Part Screws Mat'l 410 Treatment H.T. Cycle 15 Hr Net 25# Wt/pc

COST AND EXPENSE PER 8 FURNACE LOAD (2 Per Hours)

DIRECT LABOR 4 min/load x 8 loads = 32 min/60 min/hr	$ 1.28
TREATING MATERIALS	
Fuel 240 kwh x 1¢/kwh (70 kw/hr)	1.40
* Ipsen-Gas Argon Mix 700 cu.ft. (140 cu.ft.)	1.40
Carburizing Gas	———
Ammonia Gas	———
MAINTENANCE 50¢/hr	1.00
PRIME COSTS (Total of Labor, Mat'l and Maint.)	5.16
FACTORY OVERHEAD (300 % of Direct Labor Cost)	3.84
TOTAL COST OF WORK PRODUCED	9.00
Cost per Pound 8 x 25# = 200#	$ .045
Cost per Piece	———

* Does not include cost of generating equipment (estimated at $1.00/hr

FIG. 5. Sample Vacuum unit cost record sheet used at Ipsen Industries.

Part Screws Mat'l 410 Treatment H.T. Cycle 7 Hrs Net 25# Wt/pc

COST AND EXPENSE PER 1 FURNACE LOAD

DIRECT LABOR 15 Min @ 2.40/hr	$ .60	(.60)
TREATING MATERIALS		
Fuel 96 kwh x 1¢/kwh	.96	(.96)
* Ipsen-Gas N2 $2.30/100 cu.ft.	2.02	(.20)
Carburizing Gas	———	
Ammonia Gas	———	
MAINTENANCE 50¢/hr	1.00	(1.00)
PRIME COSTS (Total of Labor, Mat'l and Maint.)	4.58	(2.76)
FACTORY OVERHEAD (300 % of Direct Labor Cost)	1.80	(1.80)
TOTAL COST OF WORK PRODUCED	6.38	(4.56)
Cost per Pound	$ .026	(.019)
Cost per Piece	———	

* Based on bottled Nitrogen; Generator Nitrogen costs 1/10 as much

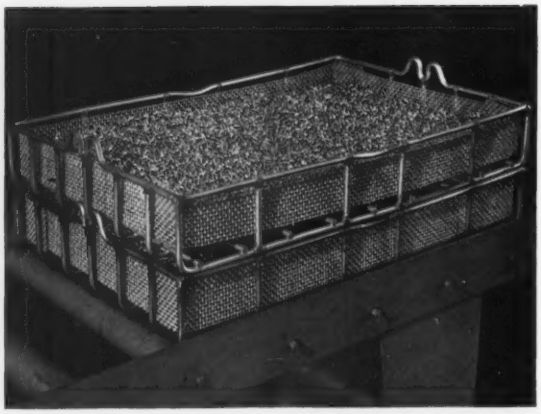


FIG. 6. SCREWS. Load: gross—302#; net—242#.

AISI		AISI	
410	(Harden)	410	(Harden)
8 min.	Pump down to 1 Micron	25 min.	Soak at 1850 F.
45 min.	Heat to 1850 F.	35 min.	N_2 Fast Cool
	Result: Hardness Rc 42-44		

FIG. 7. RINGS. Load: gross—190#; net—100#.

VASCO-JET 1000	(Harden and Temper)	VASCO-JET 1000	(Harden and Temper)
15 min.	Pump down to 2 Microns	15 min.	Pump down to .01 Micron
40 min.	Heat to 1850 F.	16 min.	Heat to 1210 F.
45 min.	Soak at 1850 F.	120 min.	Soak at 1210 F.
40 min.	N_2 Fast Cool	36 min.	N_2 Fast Cool
Result:	Hardness Rc 60-62	Result:	Hardness Rc 36-40

cooling cycle the gas regulator maintains a slight negative pressure to insure tight vessel seals. After the work is cooled a signal light flashes indicating the unit is now shut down or ready for another cycle.

The two cost sheets reveal the cost of heat treating screws, Fig. 4 for the hydrogen furnace, and Fig. 5 for the vacuum unit.

The labor involved in the operation of VFC-300 consists of the time for loading two baskets, double-decking, rolling it into the furnace from a roller top dolly, and setting the temperature and cycle program. After the load has been processed, the operator removes the work from the furnace and then from the baskets. This requires approximately 15 minutes for a 242 pound net load. (Fig. 6.) The trays for the hydrogen furnace are approximately one-fourth the size of the vacuum unit, 12 in. by 18 in., and are not double-decked. Although approximately one-quarter the time is required for each loading, the total labor time becomes twice as great for the same productivity.

The electrical load on the VFC is 75 kw., which is the same as the maximum input of the hydrogen furnace unit. The total electrical consumption for the hydrogen furnace for two hours is 140 kwh. The total consumption of the vacuum unit is 96 kwh. for the same time. It should be remembered that the VFC heating and vacuum components are operating for only two-thirds of the cycle. The atmosphere gas consumption for the hydrogen furnace is a continuous 370 c.f.h., and for two hours time it is 740 c.f. The VFC requires only 88 cu. ft. to fill the vessel. No purging or additional gas is required on this unit. Dissociated ammonia costs are based on anhydrous ammonia at nine cents per pond. A nitroneal generator would reduce gas costs for the vacuum unit from approximately $2. to 15 cents, which would reduce the cost per pound to less than two cents.

Maintenance costs for the vacuum unit are estimated. Maintenance costs for the hydrogen furnace do not include cooling down time, heating time, and soaking time to obtain the correct operating dewpoint. None of these times are required for vacuum. Alloy depreciation is the biggest maintenance cost item, and the alloy content of the vacuum unit is less than one-half of the hydrogen muffle.

Factory overhead is a fact open to discussion, although it is well known that these costs are for concerns with a captive heat treat and do not reflect additional cost incurred in job work, such as that performed by commercial heat treaters. (Figs. 7 and 8.) The commercial concern must consider such added factors as pickup and delivery, inspection, laboratory, order and service, and changeover time from one process to another.

Normally, 300% markup of direct labor equals the factory overhead. The cost of work produced does not include cost for administrative, selling, advertising, profit, and other expenses of this nature.

In any complete cost study, costs for non-productive

operation must be considered. Normally, furnaces operate 24 hours per day—5 days per week—and 50 weeks per year, or 6,000 hours a year. This is less than 70% of the year. During the 30% non-productive time the costs for hydrogen units must include the electrical power for idling at operating temperature and gas consumption to maintain the correct operating dewpoint. The vacuum unit is completely shut down and does not require any utilities or supervisory attention.

In addition, a VFC vacuum unit has advantages other than quality and cost over the hydrogen furnace:

1. The vacuum work basket is 22 in. by 34 in., which is four times the size of the hydrogen tray. Any part that can be contained within these dimensions can be processed.

2. In the vacuum unit there is no movement of the work during processing. The vacuum unit can maintain load density of 75 pounds per sq. ft., which is four times the recommended load of hydrogen furnace. The vacuum uses refractory tubes for support and the trays do not have to push one another.

3. In normal operation, the unit is evacuated, then heat is applied, and finally, gas is introduced during the soak. However, if vacuum is detrimental to the process, the gas can be admitted at the start of the operation and it can be flushed through the vacuum unit by the pumping system to obtain a continuous purge.

4. Reducing or neutral gases such as endo, hydrogen, nitrogen, argon, helium, propane, butane, or natural gas may be used.

5. Partial pressure may be maintained by back filling to the desired pressure or by continuous filling and controlling of the pumping speed.

6. The VFC-300 has a maximum continuous operating temperature of 2250 F., which is 100 to 150 degrees higher than the hydrogen furnace. The furnace can be removed from the vacuum shell and higher temperature components constructed into the furnace proper to make the unit capable of operating at temperatures of 3000 or 4000 F. In these cases the hearth size is reduced in direct proportion to the increase in temperature.

7. A three inch water cooled glass viewing port with its own manually operated and insulated door allows the operator to observe the work in progress. The vacuum helps insulate the glass port. In the muffle of a hydrogen unit the work can be observed only through double doors or special tubes welded to the heated muffle.

8. At maximum furnace temperatures, no sensation of heat is either felt or transmitted to the operator since the unit is either completely water jacketed or scribed. The work and the furnace is always clean. White stocking gloves are recommended for the operator's hands. When the door is opened for either loading or unloading the work, the furnace is cold. Accidental dropping of hot parts and trays is avoided.

9. There is no hydrogen or gas present to create a possible explosive condition when loading and unloading. There is no danger of an electrical shock since there is no power used when loading and unloading.

10. Since heating and soaking vacuum treated parts obey the laws of physics, no chemical or gas analyzing equipment is required. The gases used in a vacuum furnace are only a cooling medium.

11. The cooling rate can be varied by cooling under different gases, cooling under a vacuum, using different fan speeds, or by program control of reduction of heat input through the temperature instrument.

12. After completing one cycle the work can be started on another cycle without removing the work. For example, a Stainless Braze at 2050 F. is cooled, then reheated to 1850 F., and fast cooled. Another example is Udimet 500 heated at 2100 F., fast cooled, reheated to 1975 F., fast cooled, reheated again to 1600 F. and fast cooled.

13. Inasmuch as each starts with a vacuum and with a cold furnace, the previous cycle or temperature has no effect on the following heat.

14. Since there is no gas curtain flame, pilots, or burning of the hydrogen, there are no dirt producing elements present. The vacuum unit can be placed in an area comparable to an office.

The process of vacuum heat treating is relatively new and its advantages are still being discovered. As more experience is gained, greater metallurgical skills will add to these advantages in the ensuing years.

• • •

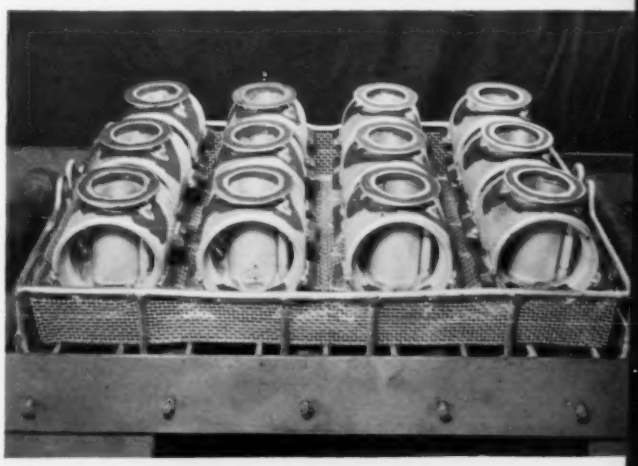
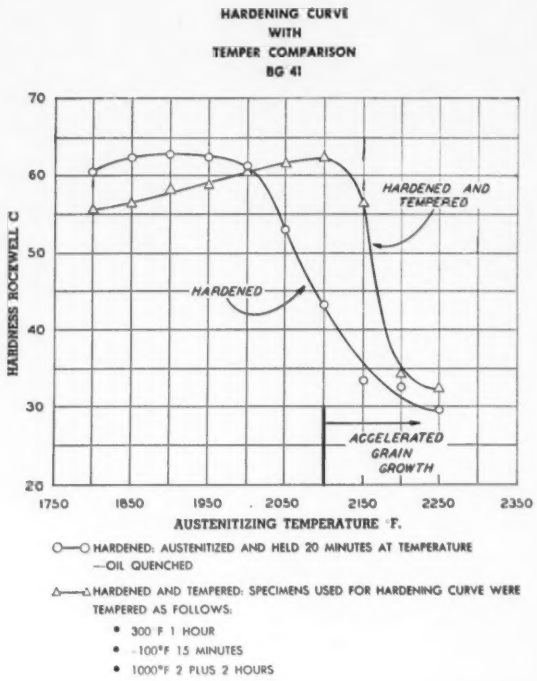


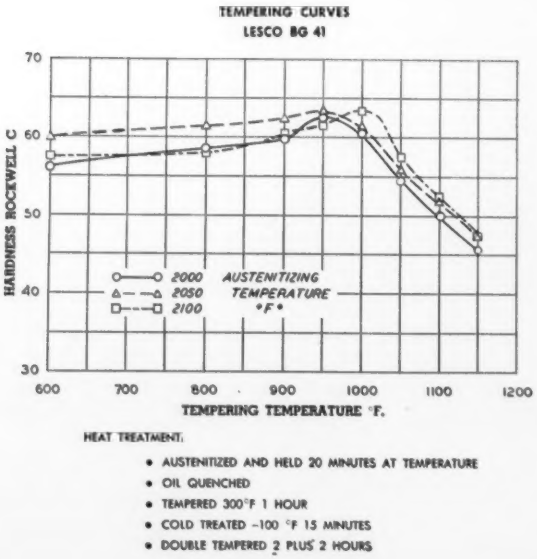
FIG. 8. PROP HUBS. Load: gross—254#; net—210#.

4340	(Braze)	4340	(Braze)
15 min.	Pump down to 15 Microns	8 min.	Heat to 1950 F.
44 min.	Heat to 1800 F.	15 min.	Soak at 1950 F.
40 min.	Soak at 1800 F.	70 min.	N_2 Fast Cool

HEAT TREATMENT OF A SPECIAL STAINLESS ALLOY*

** Ed. Note: From time to time we receive from metal producers details of heat treating procedures applicable to special materials which they develop. The following facts about a special stainless alloy are typical. Readers should find these helpful.*





LESCO BG41, a modification of regular 440-C stainless steel, was developed by Latrobe Steel Company, Latrobe, Pennsylvania, for highly stressed bearing applications which operate under corrosive conditions and at elevated temperatures. The nominal chemistry of LESCO BG41 is as follows:

C	S	Mn	Cr	V	Mo
1.05	.30	.50	14.50	.12	4.00

The recommended heat treatment for Lesco BG41 is: austenitize at 2050 F., oil quench; temper at 300 F., 1 hour; cold treat at approximately 100 F., ½ hour; temper 950 F., 2 + 2 hours.

Early in the development of this alloy it was apparent that the realization of improved hot hardness characteristics available with this analysis would necessitate the use of a hardening temperature higher than that normally employed with regular 440-C stainless. To determine the optimum hardening temperature a series of tests was conducted, the results of which are illustrated in figure 1. These curves (hardening curve with temper comparison) show the "as quenched" hardness resulting from different austenitizing temperatures, coupled with the resulting tempered hardness when a 2 + 2 hours temper at 1000 F. was employed.

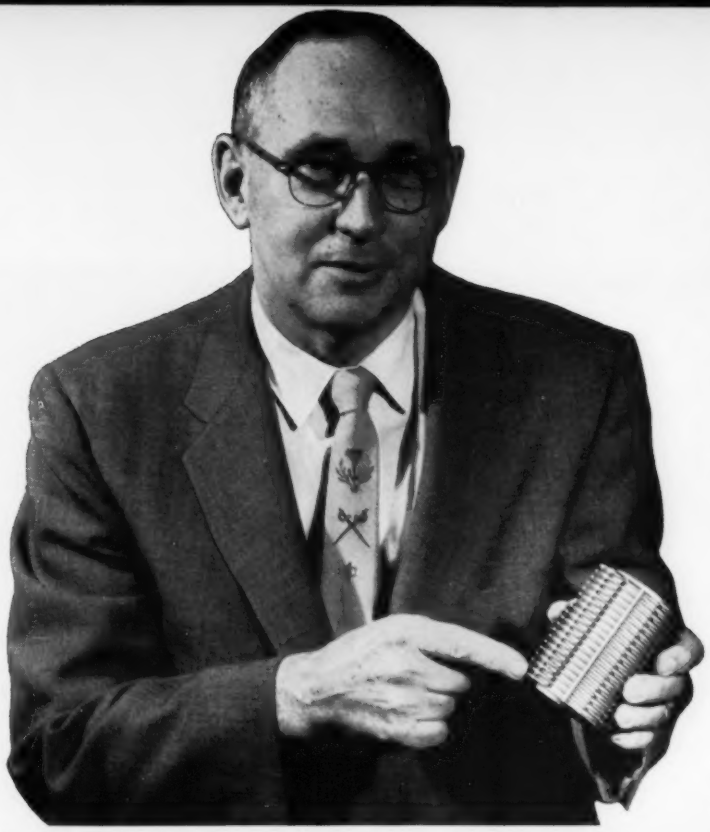
The hardening temperature of 2050 F. was selected since its use takes full benefit of the secondary hardening characteristic of the alloy, and it has no tendency for accelerated grain growth.

An oil quench is recommended for Lesco BG41, although an air quench may be employed in smaller section sizes with no adverse effects.

The use of a deep freeze prior to tempering in the secondary hardening range tends to flatten out the peak of the tempering curve at the secondary hardening range. For this reason it is a valuable tool in the heat treatment of Lesco BG41. It also means that the final heat treated hardness can be predicted more easily. The stability of the alloy is also enhanced.

Realizing that the bearing components made from Lesco BG41 could be somewhat intricate in design, it was felt that perhaps a deep freeze treatment directly following the oil quench would not be desirable. In order to eliminate this possible source of thermal cracking, tests were conducted to determine the type of stress relief treatment which might be employed without altering the beneficial effect of the cold treatment.

concluded on page 34



CHARLES SAENGER tells how Lindberg equipment produced better cutters and hobs

QUOTE

Charles Saenger, Chief Metallurgist for the Illinois Tool Works in Chicago, Illinois.

"Unground form cutters and hobs require certain refinements above and beyond those needed for ground tools. Our Lindberg-Upton salt-bath units and daily chemical control of the salt-bath solutions help us maintain an excellent surface condition and hold to critical dimensional tolerances and close hardness range required by these tools. We are very well pleased with the consistent, trouble-free service our Lindberg-Upton furnaces have provided month in and month out."

For further information circle No. 93

The success of Illinois Tool Works in producing their top-quality unground form cutters and gear hobs is a well-established fact. The banks of Lindberg-Upton furnaces in their plant provide quality control in high speed steel hardening through the ability to hold rigidly the desired temperature and also assure proper salt conditions at all times.

The solution to any salt-bath furnace requirement is easy to find. Just look to Lindberg, and the complete line of Lindberg-Upton high and low temperature furnaces for every production process where salt-bath equipment is needed. For complete information just call the nearest Lindberg representative (he's listed in your classified phone book) or, if you prefer, write us direct. Salt Bath Furnace Division, Lindberg Engineering Company, 2466 West Hubbard Street, Chicago 12, Illinois.

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also, Lindberg plants in Argentina, Australia, England, France, Italy, Japan, Spain, Switzerland and West Germany.

LINDBERG
heat for industry

One of the Lindberg-Upton Salt Bath Furnaces at Illinois Tool Works

F HOUGHTON & CO
INDUSTRY'S PARTNER IN PRODUCTION

C.I. HAYES INC.
CONTROLLED ATMOSPHERE
BRAZING FURNACES

PYRO-EYE
PYRO-OGG

PACIFIC SCIENTIFIC CO.

SELAS

HOLCROFT

1961 WESTERN METAL SHOW

DRAWS UNPRECEDENTED CROWDS

Shown on the opposite page are typical displays of interest to the heat treating industry at the Western Metal Show.

TECHNICAL SESSIONS on new equipment, atmospheres, coatings and techniques for heating both ferrous and nonferrous metals were among the topics that attracted unprecedented crowds to the Twelfth Western Metal Exposition and Congress held at Los Angeles March 20-24. Highlighting the Exposition were a number of seminars covering a wide range of industry products.

Orville E. Cullen, director of research and development for Surface Combustion Company, discussed the topic of new equipment which is currently increasing the skill and precision of work done by metal treaters. He cited handling devices, automatic cycling, and furnace enclosures which are both atmosphere and vacuum tight for positive purging and optimal quenching as recent developments of particular importance.

"Engineering applications of forced convection to accelerate heat transfer and improve temperature and atmosphere uniformity in furnace work," Cullen said, "have reached a high degree of perfection. Heat treating furnaces and auxiliary equipment are tailored to meet processing needs, rather than appearing as attempts to fit the process to available equipment."

Dr. W. R. Varney of Angeles Steel Treating Corportation, Los Angeles, described the advantages of various inert atmospheres used in processing steels and heat resistant alloys.

Etric L. Stone of Boeing Airplane Company's Aerospace Division, Seattle, emphasized the following points with reference to the coating of parts prior to heat treatments:

1. Types of coatings in current use can be generally classified as scale conditioners, mechanically bonded protective materials, and plated or diffusion finishes.

2. Applicational methods range from brushing, dipping and spraying to electrolytic and thermochemical deposition techniques.

3. Coatings should be selected in conformity with predictable metallurgical or chemical reactions, part size and thickness, heat treat environment, retorts and associated tools, and ease of removal.

4. The cost of coatings is important where parts must be heat treated in large quantities.

R. H. Lundquist, metallurgist for California-Doran Heat Treating Company, Los Angeles, asserted that much remains to be learned about holding heat treated metal components to accurate size and geometry due to the increasing complexity of parts and the limitations of available furnaces.

"The skilled metallurgist and heat treater," Lundquist pointed out, "can control dimensions and prevent excessive deformation if he has experience, background, good equipment, and sufficient money to spend for necessary tooling.

"Much of the successful work has utilized tooling applied after the quench and prior to the tempering operation. The tooling corrects distortion caused in the quench and confines the part during the tempering cycle so it will take a permanent set and be of proper size and shape.

"However, recent trends toward higher strength levels have caused tempering temperatures to be decreased—making corrections more difficult during the tempering cycle.

"It will be necessary to devise methods of preventing distortion during quenching, so that a minimum amount of correction will be required at the lower tempering temperature."

In a talk on metals research, Professor Earl R. Parker of the University of California, Berkeley, observed that it is very important for persons working with materials in advanced applications to familiarize themselves with the fundamental phenomena that govern the behavior of metals. In this connection, he stressed the significance of plastic flow and fracture, explaining that the property of ductility, which makes metals so valuable, is due to defects called dislocations in crystal structures.

With respect to this, Parker stated, "Although the role played by dislocations in the plastic behavior of

continued on page 43

FURNACE ATMOSPHERE ANALYZER-CONTROLLER

Yield

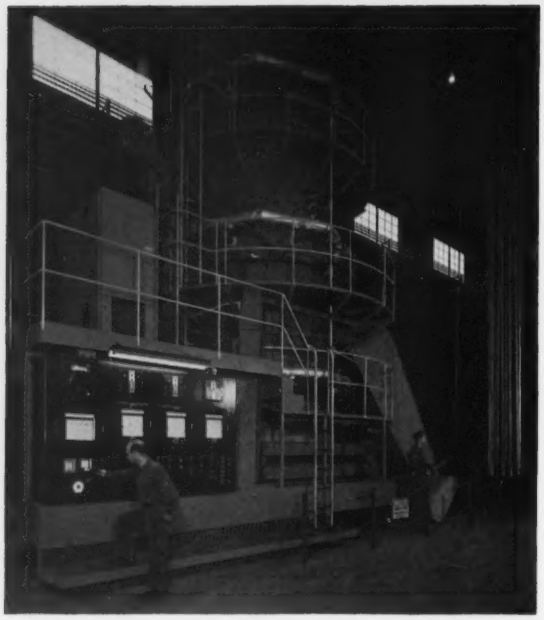


FIGURE 1

FIG. 1. Overall dimensions of this automatically controlled furnace, which is one of the largest in the United States, are 27 ft. by 18 ft. by 40 ft high. Maximum load size is 68 in. diameter by 27 ft. long. Loading and quenching pits, located below floor level, are 10 ft. in diameter by 36 ft. deep. The furnace atmosphere is continuously monitored and controlled by chromatographic instrumentation designed and built by Perkin-Elmer Corporation, Norwalk, Connecticut. This is the first production installation of such a furnace-and-analyzer combination.

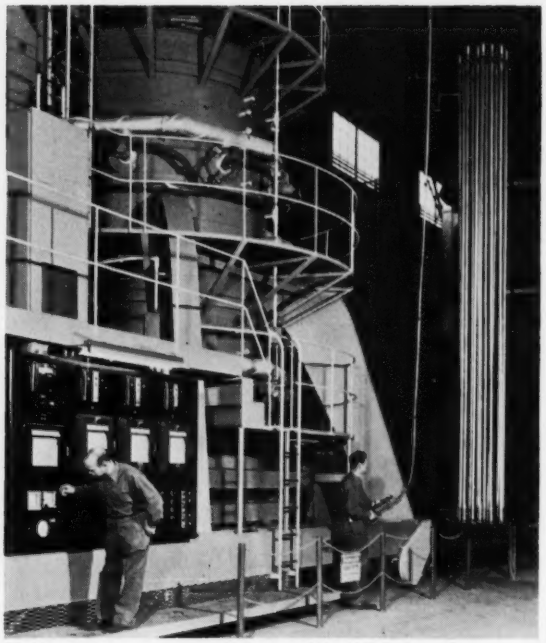


FIGURE 2

FIG. 2. Suspended alongside the furnace prior to loading, these 20 ft. drill rods give a good indication of furnace capacity. The operator at left is checking recorders that are part of the furnace analyzer equipment. These chart recorders provide a permanent record of concentrations of the four atmosphere components being monitored. They also serve as a check on the performance of the automatic control system.

FIGURE 3

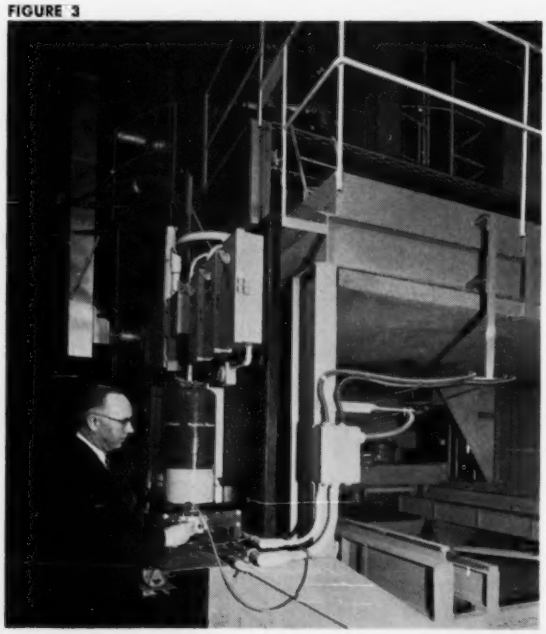


FIG. 3. The heart of the furnace atmosphere automatic control system is a Perkin-Elmer chromatographic sensing unit which enables continuous analysis and monitoring of CO_2, methane, nitrogen, and CO. The sensing unit is mounted on a switching panel at the rear of the furnace.

Remarkable Heat Treating Accuracy

BY EQUIPPING one of the largest gantry furnaces in the country with the latest in chromatographic instrumentation, Commercial Steel Treating Corporation of Detroit is achieving exceptional results in its carburizing, carbon restoration, plain heat treating, and similar processes. The huge furnace, which can handle parts up to 28 ft. long and 5 ft., 8 in. in diameter, is equipped with a four component atmosphere analyzer that automatically controls critical carbon dioxide concentration witin ±0.02%. The furnace analyzer, developed and produced by Perkin-Elmer Corporation, Norwalk, Connecticut, presents a precise, visible indication of atmosphere composition inside the furnace. It also incorporates a closed loop control system that automatically regulates the heat treating atmosphere via pneumatically actuated valves.

The importance of this furnace and analyzer combination, which is the first such production installation in the United States, can be seen by the following results. In a recent carburizing load, Commercial's engineers aimed for an 0.85 carbon percentage in the case being treated. On the very first attempt, they were able to attain a percentage of 0.81. A short time later, another steel was carburized, with 0.70% carbon as a target. The result was a figure of 0.68%.

Accuracy of this order, Commercial has found, is consistently attainable with the new analysis and control setup. The fact that carbon can be controlled with such precision is due largely to the rapid analytical capabilities of the Perkin-Elmer instrument. Directly analyzing CO_2, methane, nitrogen, and CO on a five minute cycle, the instrument reads out CO_2 concentration to within ±0.02%, and gives hydrogen concentration by simple subtraction.

Other common analytical methods are either not as direct or less precise. For example, a time consuming Orsat analysis yields gas component measurements to about 0.2% accuracies. The dew point technique only indirectly measures carbon potential. It tells nothing about the other important components of the controlled atmosphere.

Aside from the unusual accuracy of the work done with the gantry furnace, it has another major advantage —its size. As an example, among early jobs handled was the treating of 20 ft. drill rods for a leading United States producer. Previously, furnace capacities restricted such rods to lengths of about 12 ft. With this system, rod manufacturers can have 20 ft. lengths heat treated, with a corresponding reduction of joining problems, still maintaining reasonable straightness.

Details of the Furnace

The bottom loading, bottom quenching gantry furnace is a gas-fired, radiant tube unit. Able to handle 28 ft. by 68 in. diameter parts that weigh up to 6,000 pounds net, it can process huge industrial components, as well as massive rocket or missile casings.

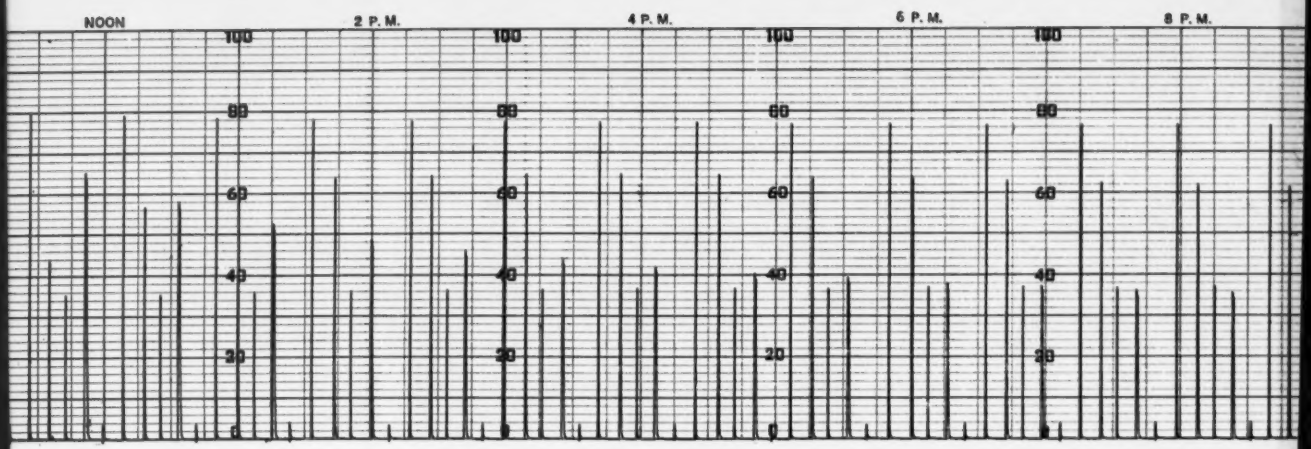
Using an electric drive system, it moves under its own power to the loading pit, centers automatically, loads parts to be treated, returns to its station, completes its cycle, quenches, and unloads. Heat is supplied by 24 tubes, in three banks of eight, around the periphery of the furnace lining and behind a full length metal shroud.

Atmosphere gases are introduced at two points behind the shroud, safely remote from the work load. A two speed squirrel cage fan in the lower lid forces the gases up past the radiant tubes and evenly down over the work load at the rate of 9,000 or 16,000 cu. ft. per minute. This shroud and fan arrangement assures positive circulation and uniform temperature throughout the entire furnace. Operating temperatures are up to 1850 F. within a ±10 degree accuracy at any level.

Parts to be processed are suspended vertically, and loading is accomplished with a built-in, variable speed chain hoist. Quench stations 10 ft. in diameter by 36 ft. deep are located below floor level. After centering the gantry directly over the pits, the remote controlled lower lid, mounted on an independent carriage, moves completely aside to allow transfer of the load to the quench pit.

Details of Furnace Analyzer

Precise control of the furnace atmosphere would not be possible without the ability of the Perkin-Elmer furnace analyzer to make completely automatic, highly accurate repetitive analyses. The analyzer is based on the same principles employed for years in laboratory chromatographs. It is similar in construction to process chromatographs now used in hundreds of installations in the petroleum and petrochemical industries to monitor and control the composition of process streams. Chromatographs, whether laboratory or process, take samples of mixtures, separate them into individual components, and measure the amount of all or selected key components. Fixed volume samples are swept by an



inert carrier gas through a length of tubing, usually known as the chromatographic column, and packed with granules of diatomaceous earth coated with a liquid in which the components of the sample are soluble to differing extents. As the components pass through the column they are retarded to differing degrees. This allows them to emerge from the outlet separately. A simple thermal conductivity cell at the column outlet measures the concentration of the emerging components, and transmits this information to a recorder.

The compositions of furnace atmospheres may include any of the following components: H_2, O_2, N_2, CO, CO_2, CH_4, NH_3, and water vapor. Since some of these have much longer column retention times than others, and since the same packing materials are not effective for all, the furnace analyzer is designed to use several different columns. A single sensing unit monitors all of the columns via an ingenious column switching arrangement.

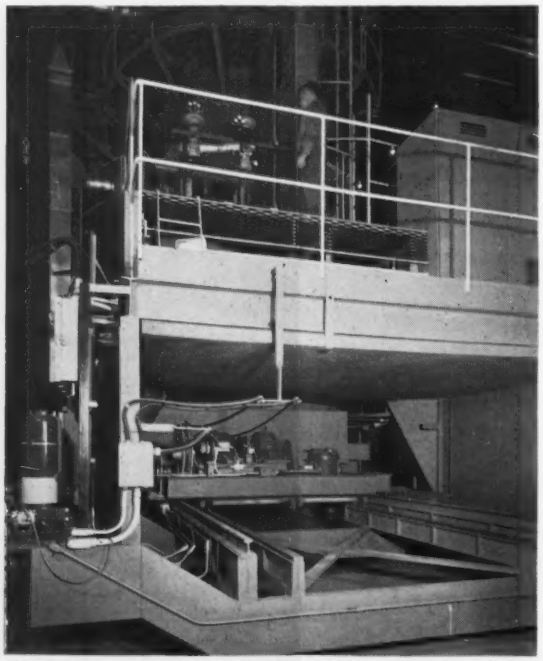


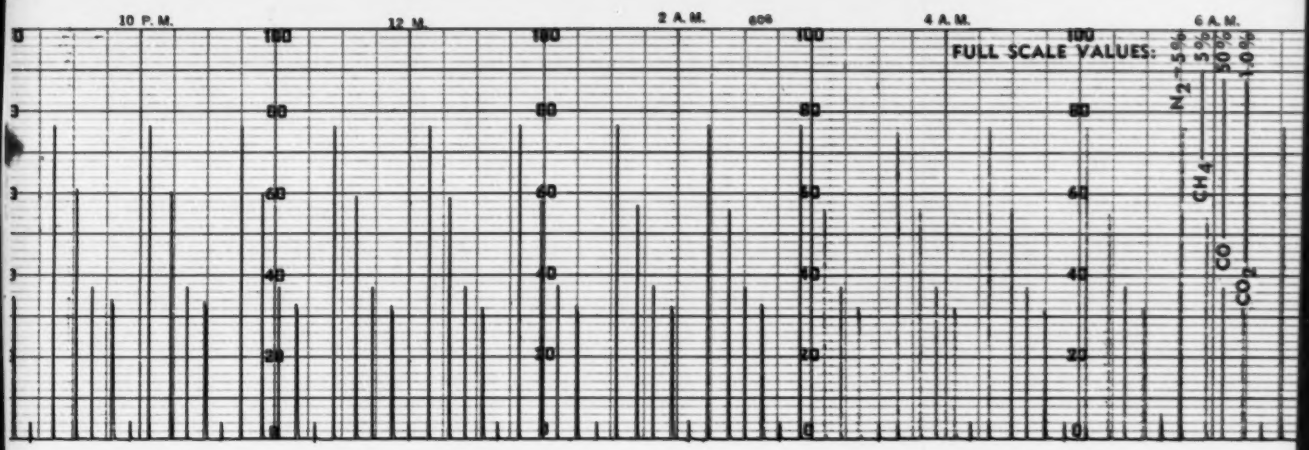
FIG. 4. Two major components of the furnace atmosphere control system are the chromatographic column in the cylindrical housing (lower left), and a pneumatic control valve assembly (being observed by the operator). Operated automatically by signals from the chromatographic control system, the valve assembly adds air or methane to the furnace atmosphere as required.

Associated with the sensing unit are a programmer and a recorder. The programmer controls the functions of the sensing unit and allows specific components of interest to be programmed for readout on the recorder's bar chart. The programmer attenuates the concentration signals from the sensing unit so the recorder presents the concentration of individual components directly in volume percent. On demand, the analyzer will deliver a complete, conventional chromatogram, showing the presence of any other components besides those programmed for routine measurement.

To assure dependable performance under the difficult conditions present around heat treating and other types of furnaces, gas sample handling and conditioning equipment has been designed with the following conditions in mind:

1. The gas may be dirty or sooty.
2. The gas may be saturated with water vapor.
3. Gas pressure may not be high enough to cause flow through the analyzer.
4. Gas flow should be metered to assure that the analyzer is always receiving a fresh sample.

The resulting sample system includes a coarse filter, an oilless vacuum pump, a filter saturator, a final sampling assembly, and a flowmeter. The coarse filter removes dirt and soot from the gas stream and protects the vacuum pump. The pump assures pressure for adequate sample flow, and a saturation filter is included in the system to provide wet gases with a uniform moisture content and a place for removing condensed water. This is necessary because the analyzer always withdraws a constant volume of gas from the sample stream. If the moisture content in the gas is allowed to pass to the analyzer uncontrolled the volume of gas introduced into the constant volume sample loop will vary with moisture concentration and the CO_2



removed in condensed water. The filter saturator eliminates this problem.

Final sampling assembly provides a means for bypassing part of the sample, introducing a calibration sample, fine filtering, and flow regulation. A flow meter checks the performance of the sampling system.

The gas analyzer and sampling system are mounted on a single compact assembly which also provides space for the carrier and calibration gases. To put the analyzer into service, the user simply connects a sample line between the furnace tap and the sample manifold and plugs the power cord into the nearest 115 volt source.

The sensing unit and programmer have a millivolt output signal which is fed into a Perkin-Elmer accessory called a peak picker. This automatic unit is the key to the pneumatic control system (see chart). It "picks out" and remembers a predetermined component

concluded on page 44

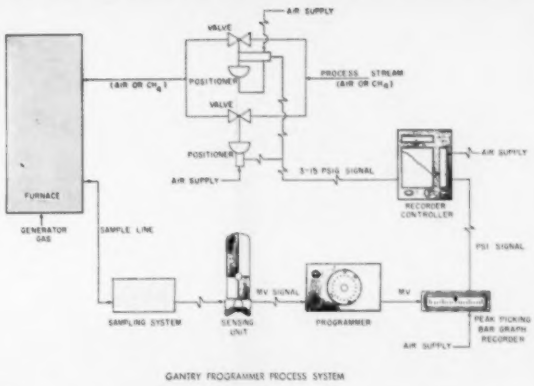


FIG. 5. An electro-pneumatic control system assures automatic, accurate maintenance of the desired heat treating atmosphere inside the gantry furnace. A major component of the system is the peak picker, which selects the millivolt signal of the desired component in the sample and converts it to a corresponding pneumatic signal. The use of two valves assures both precise and smooth control of air or methane added to the furnace. One of the valves, with a 0 to 10 cu. ft. rating, is set to open over a 3 to 9 psig signal range; the other, rated from 20 to 200 cu. ft., opens over a 9 to 15 psig range.

FURNACE ANALYZER
Maximum Sensitivity for Common Gases*

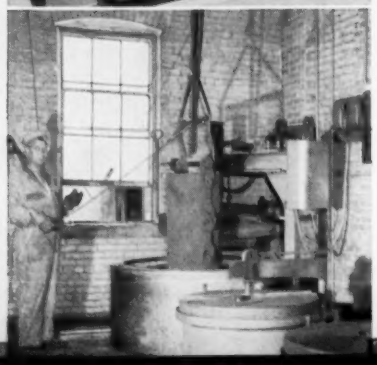
Maximum Sensitivity for	Lowest Full-Scale Concentrations 10 Millivolt Recorder Volume %	Concentration Per Chart Division Volume % Per Chart Division
H_2	0-20	0.2
N_2	0-1.0	0.01
O_2	0-1.0	0.01
CH_4	0-2.0	0.02
CO	0-4.5	0.045
CO_2	0-0.6	0.006
H_2O	0-2.0	0.02
Maximum Sensitivity for	**5 Millivolt Recorder Volume %**	**Volume % Per Chart Division**
H_2	0-20	0.2
N_2	0-0.5	0.005
O_2	0-0.5	0.005
CH_4	0-1.0	0.01
CO	0-1.5	0.015
CO_2	0-0.3	0.003
H_2O	0-2.0	0.002

* Ranges shown are maximum sensitivity limits, and they may vary with the type of analysis. Any component programmed may be adjusted to lower sensitivities up to 100% full scale.

FIG. 6. A second Perkin-Elmer analyzer, similar to the one installed on the gantry furnace, is mounted on a mobile cart.

TODAY THE TREND IS UP

Modern specifications call for better properties achieved by better heat treating —check with your commercial heat treater



Whenever a modern product is improved or a new one developed it has now reached a point where the heat treating procedures and processes to be applied to basic component parts are among the original factors to be considered. In the past, fabricating methods and metals were frequently the first to be specified and heat treating, if involved at all, was a secondary problem.

Because of this and because of the new and exceptional design characteristics and ultimate engineering properties which can be achieved only through skillful and accurate heat treating, the tonnage volume of heat treating materials processed by the commercial heat treating industry grows steadily month after month.

There is another reason for this and it is found in the fact that only the commercial heat treater offers practically an all inclusive diversity of plant facilities, but even more important, the accumulation of technical skills, experienced personnel, and the background of knowledge so essential to this field.

If you would like to receive a charted monthly report of the volume of activity in this industry, write us on your company letterhead. We will be glad to send it to you.

Whatever your heat treating problem, always check with your commercial heat treater first.

THERE'S A HEAT TREATING SPECIALIST NEAR YOUR PLANT

ALABAMA

Southern Metal Treating Co., Inc.
3131 10th Ave. N., Birmingham 4

CALIFORNIA

Downey Steel Treating Co., Inc.
9637 Nance St., Downey
Columbia Industries, Inc.
6057 State St., Huntington Park
National Heat Treating Co., Inc.
1833 W. Florence, Inglewood 1
Certified Steel Treating Co.
2454 E. 58th St., Los Angeles 58
Lindberg Steel Treating Co.
2910 S. Sunol Drive, Los Angeles 23
Cook Induction Heating Co.
4925 East Slauson Ave., Maywood

CONNECTICUT

Commercial Metal Treating, Inc.
89 Island Brook Ave., Bridgeport 6
Stanley P. Rockwell Co.
296 Homestead Ave., Hartford 12
Ireland Heat Treating Co.
512 Boston Post Road, Orange

FLORIDA

Rex of Florida, Inc.
1881 S.W. 36th St., Fort Lauderdale

ILLINOIS

Accurate Steel Treating Co.
2226 W. Hubbard St., Chicago 12
Allied Metal Treating Corp. of Illinois
333 N. California Ave., Chicago 12
Dura-Hard Steel Treating Co.
2112 W. Rice Street, Chicago 22
Perfection Tool & Metal Heat Treating Co.
1756 West Hubbard St., Chicago 22
Fred A. Snow Co.
1942 West Kinzie St., Chicago 22
American Steel Treating Co.
P. O. Box 396, Crystal Lake
Lindberg Steel Treating Co.
1975 N. Ruby St., Melrose Park
Eklund Metal Treating, Inc.
721 Beacon St., Rockford
Scott Ford, Inc.
2719 Fifth St., Rock Island
Ipsenlab of Rockford, Inc.
2125 Kishwaukee Street, Rockford
O. T. Muehlemeyer Heat Treating Co.
1500 Preston St., Rockford

INDIANA

Quality Steel Treating Company
3860 Prospect St., Indianapolis
Industrial Heat Treating & Metallurgical Co., Inc.
2131 Northwestern Ave., Indianapolis 2

MASSACHUSETTS

Kinetics Corporation, a Division of High Vacuum Equipment Corp.
2 Churchill Road, Hingham
Porter Forge & Furnace, Inc.
74 Foley St., Somerville 43

MASSACHUSETTS — (Cont'd)

New England Metallurgical Corp.
475 Dorchester Ave., South Boston 27
Springfield Heat Treating Corp.
99 Margaret Street, Springfield
Greenman Steel Treating Co.
284 Grove St., Worcester 5

MICHIGAN

Anderson Steel Treating Co.
1033 Mt. Elliot Avenue, Detroit 7
Bosworth Steel Treating Co.
18174 West Chicago Blvd., Detroit 28
Commercial Steel Treating Corp.
6100 Tireman Ave., Detroit 4
Commonwealth Industries, Inc.
5922 Commonwealth Ave., Detroit 8
Vincent Steel Process
2424 Bellevue Ave., Detroit 7
State Heat Treat, Inc.
520 32nd Street, S. E., Grand Rapids 8
Royal Oak Heat Treat, Inc.
21419 Dequindre, Hazel Park
Vac-Hyd Processing Corp.
116 Manchester, Highland Park 3

MISSOURI

Lindberg Steel Treating Co.
650 East Taylor Ave., St. Louis 15
Paulo Products Co.
5711 West Park Ave., St. Louis 10

NEW JERSEY

Fred Heinzelman & Sons, Inc.
790 Washington Avenue, Carlstadt
American Metal Treatment Co.
Spring and Lafayette Sts., Elizabeth
Benedict-Miller, Inc.
Marin Ave. & Orient Way, Lyndhurst
Bennett Heat Treating Co., Inc.
246 Raymond Boulevard, Newark 5
L-R Metal Treating Corp.
107 Vesey St., Newark 5
Temperature Processing Co., Inc.
228 River Road, North Arlington

NEW YORK

Owego Heat Treat, Inc.
Rural Route 1, Apalachin
Eastern Heat Treating & Brazing Corp.
44 Sea Cliff Avenue, Glen Cove
Alfred Heller Heat Treating Co., Inc.
391 Pearl St., New York 38
Lindberg Steel Treating Co.
620 Buffalo Road, Rochester 11
Rochester Steel Treating Works
962 Main Street, E. Rochester 5
Syracuse Heat Treating Corp.
1223 Burnet Ave., Syracuse 3

OHIO

Queen City Steel Treating Co.
2980 Spring Grove Ave., Cincinnati 11
Ferrotherm Co.
1861 E. 65th St., Cleveland 3
Lakeside Steel Improvement Co.
5418 Lakeside Ave., Cleveland 14

OHIO — (Cont'd)

George H. Porter Steel Treating Co.
1273 East 55th Street, Cleveland 3
Reliable Metallurgical Service, Inc.
3827 Lakeside Ave., Cleveland 14
Winton Heat Treating Co.
20003 Lake Road, Cleveland 16
Dayton Forging & Heat Treating Co.
2323 East First St., Dayton 3
Ohio Heat Treating Co.
1100 East Third St., Dayton 2

PENNSYLVANIA

Drever Company
Red Lion Rd. & Philmont Ave., Bethayres
Robert Wooler Company
Dresher
Wiedemann Machine Co.
Gulph Road, King of Prussia
J. W. Rex Co.
Eighth and Franconia Avenue, Lansdale
Lorenz & Son
1351 N. Front St., Philadelphia 22
Metlab Company
1000 E. Mermaid Lane, Philadelphia 18
Pittsburgh Commercial Heat Treating Co.
49th St., and A.V.R.R., Pittsburgh 1

TENNESSEE

Mid-South Metal Treating Co.
463 Scott St., Memphis 12

TEXAS

Dominy Heat Treating Corp.
P. O. Box 5054, Dallas
Superior Heat Treating Co., Inc.
P. O. Box 69, Fort Worth 1
United Heat Treating Company
2005 Montgomery Street, Fort Worth 7
Cook Heat Treating Co., of Texas
6233 Navigation Boulevard, Houston 11
Houston Heat Treating Company, Inc.
2100 Quitman Street, Houston 26
Lone Star Heat Treating Corp.
5212 Clinton Dr., Houston 20

WISCONSIN

Allied Metal Treating Corp.
P. O. Box 612, Milwaukee 1
Heat Treating Engineers, Inc.
1146 North 54th St., Milwaukee 8
Metal Treating, Inc.
720 South 16th St., Milwaukee 4
Supreme Metal Treating Co.
4440 West Mitchell St., Milwaukee 14
Thurner Heat Treating Co.
809 West National Ave., Milwaukee 4
Wisconsin Steel Treating & Blasting Co.
1114 South 41st Street, Milwaukee 15
Harris Metals, Inc.
4210 Douglas Ave., Racine

All of the above listed firms are members of the

METAL TREATING INSTITUTE

Box 448, Rye, New York

MTI MASTER CRAFTSMEN METAL TREATING INSTITUTE

For further information circle No. 94

WHAT WOULD YOU DO?

a problem in labor arbitration taken from the files of the American Arbitration Association

CASE OF THE SECOND PLACE BIDDER

When a vacancy occurred in the polishing department of an automobile parts plant, the job was posted and, after a number of bids were entered, awarded to the applicant with most seniority. Harold K., second in the order of seniority, thought he should have gotten the job because of his ability, but he didn't make an issue of it.

After the successful bidder was on the job for two weeks, however, he quit and went to work for another company. Management thereupon ordered Harold to move up to that spot.

Harold refused. "I bid for that job two weeks ago and I didn't get it," he said. "Now I don't want it. You can post the job over again and give it to the bidder with top seniority. I won't be among the bidders."

"We don't have to post that job again," answered the personnel manager. "The contract calls for a 30 day trial period for successful bidders. The polisher quit within that period, so we can assign the job to the man who was next on the list."

Harold was still miffed about the company's action and filed a grievance, which went to arbitration under the rules of the American Arbitration Association.

THE AWARD. Harold was sustained. The arbitrator said that the 30 day trial period provision "does not have the effect of qualifying the finality of the initial job posting and bidding." Consequently, when the successful bidder quit, a *new vacancy* was created which had to be filled again by the posting and bidding method.

CASE OF THE "UNNECESSARY OVERTIME"

Helen C., one of five spot welders in a radio and television assembly shop, was sent home for lack of work early in March 1960. That was proper under the contract, because she had less seniority than the four other girls in her classification.

While she was on layoff, work picked up for the other classifications in the department to the point where some overtime became necessary. The spot welders still didn't have too much to do, but management decided that as long as the others were going to work one hour overtime for four days, it would be good for morale to let the four spot welders work late along with them.

When Helen found out about it she filed a grievance. "I should have been recalled from layoff before other spot welders were permitted to work overtime," she said. "Now you owe me pay for those four days."

"Under other circumstances you would be right," answered the personnel manager. "But we didn't really need the spot welders on overtime. We only let them work because everyone else in the department was working. You didn't lose anything by the extra hours they put in because there wasn't enough work to justify recalling you from layoff."

THE AWARD. The arbitrator said he could not distinguish between "economically necessary overtime" and overtime which is assigned "as a matter of good industrial relations." Therefore, he held, the grievance had merit. But Helen wasn't entitled to four days pay. The spot welders had worked a total of 16 hours. That was the extent of Helen's loss, and she was awarded two days' pay.

How would you anneal these 5 types of alloy wire?

The various types of alloy wire in this photograph are manufactured for specialized applications by the Riverside-Alloy Metal Division, H. K. Porter Company, Inc. They range from stainless steel, for aircraft industry use, to monel metal and an iron-nickel-cobalt alloy with thermal expansion characteristics suitable for sealing to hard glasses. Annealing temperatures range from 1450 to 2150 F, close control being necessary to maintain wire quality, measured by elongation, grain structure and tensile strength. The wire is annealed continuously—normally in a disassociated ammonia atmosphere.

Experience has proved that electric furnaces equipped with GLOBAR® silicon carbide heating elements offer the cleanliness and capability for precise temperature control needed in this operation. The GLOBAR elements easily provide the maximum 2150 F heat—in fact, can be used with safety to above 2750 F. One of the furnaces used, with 13½" thick walls of refractory insulating brick, has required no maintenance of the lining over a 10-year period—pointing up the mild conditions to which insulating brick are subjected with this type of heat. With the low heat capacity of the insulating brick, it is possible to drop temperatures rapidly in going from the high to low end of the range.

The many advantages of heating with GLOBAR elements, as illustrated in this particular case, often more than cancel out possible differentials in Btu costs between electricity and other fuels. Why not investigate with your furnace builder—or write to Refractories Division, Globar Plant, Dept. MT-61, Niagara Falls, N. Y.

For latest advances in silicon carbide heating elements... count on

CARBORUNDUM®

For precise, economical electric heating

GLOBAR silicon carbide heating elements

- Shipped from stock or within two weeks.
- Temperatures from 1400 to 2800 F, precisely controlled, independent of atmosphere.
- Easily replaced from outside without waiting for furnace to cool.
- "On line" operation for many applications—no transformer necessary.
- Elements 4" to 105" in length.
- For greater economy in heat treating, brazing, forging, melting and sintering.

For further information circle No. 89

About People.....

Clyde W. Clark 1893-1961

Clyde W. Clark, Sr., Dearborn, Michigan, industrialist died Friday, April 7, at University of Michigan Hospital, Ann Arbor, after an illness of several months. He was 69 years old.

Well known throughout the automotive industry, Mr. Clark organized and directed until his death, The Dearborn Tool and Die Company, which he founded in 1932.

Mr. Clark was widely known for his charitable works and as a harness horse fancier and owner of "Sharp Note" the only Michigan entry to ever win the Hambeltonian and Triple Crown.

Surviving are his wife, two sons, a brother and sister and eight grandchildren.

Ernest Edgar Thum 1885-1961

Ernest Edgar Thum, 76, director of editorial services of the American Society for Metals, Metals Park, Ohio died suddenly Monday morning, April 10, 1961, in Coronada Beach, California, where he was vacationing with his wife, Margaret.

Mr. Thum was editor in chief of *Metal Progress*, the Society's monthly magazine, and was its first editor when the magazine was established in 1930. He was named editor in chief in 1958. Only a month ago he had been appointed director of editorial services in charge of all Society periodical and reference publications.

He was an international authority on metallurgy, widely known in Europe where he had made many trips in behalf of the Society and *Metal Progress*. He numbered among his friends many of the leading engineers and scientists in Great Britain, France, West Germany, Italy, and in Japan.

In 1939-40, he was a member of the original War Metallurgy Committee of the National Research Council during World War II, at which time he prepared a comprehensive report on secondary copper supplies. Since 1948, he has been active in the Advisory Committee on Industrial Information to the U. S. Atomic Energy Commission, serving as chairman from 1956-60. He also served as a member of the Advisory Committee to the United States Air Force on Potentials and Utility of Castings for Aircraft.

To Cleveland Post

General Alloys Company has announced the transfer of R. H. Robinson to its Cleveland Territory as sales engineer and manager

R. H. Robinson

of the Cleveland district office. He succeeds Edward Whiteside, who has retired.

For the past three and one-half years Bob Robinson has been the sales engineer and manager of the General Alloys Company District Office, at Buffalo, New York. Prior to that time, he was with the Ford Motor Company, where he held diversified positions, such as metallurgical development engineer, process engineer, procurement engineer, and general foreman of Lincoln-Mercury Division heat treating.

Robinson is a graduate metallurgist, having attended both Wayne University and the University of Michigan. He is a member of the Cleveland Chapter of the American Society for Metals.

To West Coast Office

Aldo J. Sartor, sales engineer, has been transferred to Pangborn Corporation's West Coast office, Pasadena, California.

Aldo J. Sartor

A precision finishing specialist, Sartor joined Pangborn's Detroit staff in June, 1960. Prior to joining Pangborn, he was with Almco-Queens Division of King-Seeley Corporation.

Holcroft Technical Director

The appointment of Edward C. Bayer as technical director of Holcroft & Company, Detroit, Michi-

Edward C. Bayer

gan, has been announced by Walter H. Holcroft, president.

Bayer, who joined the company

Continued on page 30

EF

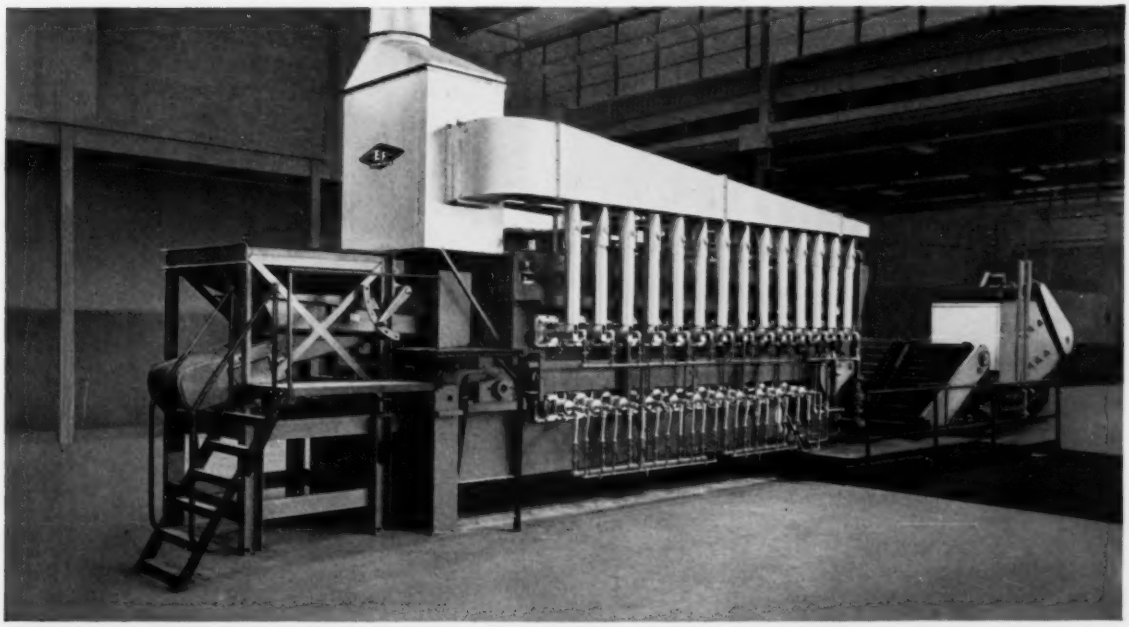
Chain Belt Furnaces

for scale-free hardening, carbon restoration, carburizing, carbon nitriding or non-decarb heat treating of small and medium size parts.

EF Chain Belt Conveyor Furnaces are ideally suited for processing a wide variety of products in a wide range of atmospheres. Their initial cost is moderate. Operation is almost completely automatic, minimizing labor costs. The material is carried directly on the belt without shaking or jarring. No pans or trays are needed, thus avoiding the necessity of heating this additional weight, and assuring high fuel economy.

Available in electrically heated or fuel fired designs. 15 standardized sizes with capacities from 175 to 3000 lbs. per hour, minimize the charges for new engineering and assure prompt delivery. Easily installed. Often shipped completely assembled requiring only connection to utilities. 7 out of every 10 new orders are from previous users attesting the serviceability and dependability of our design.

Write for Bulletin No. 601. It gives full details . . . and call the EF engineers on every heat treating project. Our long experience and extensive research and development facilities can shorten your path to low cost, profitable operation.



THE ELECTRIC EF FURNACE CO.
GAS • OIL • ELECTRIC

THE ELECTRIC FURNACE CO.

Fuel Fired and Electrically Heated
HEAT TREATING FURNACES
for Processing any Product, in any Atmosphere, any Hourly Output Required

Salem - Ohio

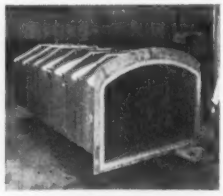
SUBSIDIARIES—Turnkey Engineering Co., Inc., South Gate, Cal. • Canefco Limited, Scarborough, Ontario
SALES REPRESENTATIVES—2842 West Grand Blvd., Detroit 2, Mich. • also 968 Coleman Rd., Cheshire, Conn.

For further information circle No. 96

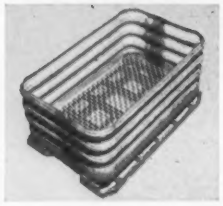
Custom FABRICATORS

DESIGNERS OF SPECIAL EQUIPMENT

High alloy such as RA-330, Hastelloy and Inconel—for the heat treating industries . . . a plant with over 50 years experience as fabricators, and grey iron castings. Illustrated above is Venturi-High Temperature Alloy.



Alloy muffle . . . example of one type fabrication job.



Corrugated baskets.

Pickling racks.

Fully illustrated colored brochure shows many types of Custom Fabrication . . . write for it today.

BERLIN CHAPMAN CO. Since 1908

BERLIN • WISCONSIN

For further information circle No. 70

ABOUT PEOPLE • • •

Continued from page 28

as a metallurgist in 1946, earned his Bachelor of Chemical Engineering degree at the University of Detroit. A World War veteran, he served in the United States Navy.

A member of the American Society for Metals, he is also a member of the American Gas Association and is currently serving on its Committee on Gas Practices.

McHugh Appointed GM at Precision Drawn Steel

John T. McHugh was recently promoted to the position of general plant manager at Precision Drawn Steel Company, Pennsauken, New Jersey. He was formerly division superintendent of wire and wire products at the Donora Plant of the American Steel and Wire Division of United States Steel.

John T. McHugh

According to Paul Newcomb, president of Precision, the large current expansion being completed at that firm created a need for top echelon personnel and McHugh brings to the position the required solid background of valuable experience needed.

Jack is an industry veteran with over 31 years experience. He began his career with United States Steel as a clerk in the nail mill.

Hevi-Duty Electric Promotes Two Executives

Promotion of two sales executives at Hevi-Duty Electric Company, Watertown, Wisconsin, has been announced by general sales manager A. W. Frank.

R. G. Martinek has been named product sales manager of the firm's five furnace and oven product lines, a new position created to co-ordinate more effectively the sale, service, and application of these di-

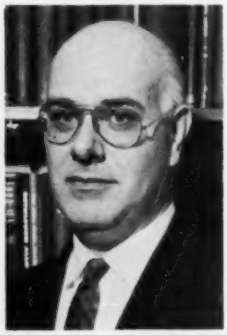
R. G. Martinek

verse lines. He was formerly manager of special industrial furnace sales, a post he still holds. A 15 year veteran in the sale and engineering of all types of furnaces in the United States, Canada, and Europe, Martinek joined Hevi-Duty two years ago.

C. A. Newton has been promoted to the position of product manager of the light industrial furnace line, reporting to Martinek. Formerly an application engineer on this line, he has spent 26 years with the Watertown firm in a variety of sales and engineering functions.

Lyman Appointed Editor ASM Reference Publication

Taylor Lyman, editor of the new ASM Metals Handbook, 8th Edition, Volume 1, *Properties and Selection of Metals,* has been appoint-



Taylor Lyman

ed editor of reference publication for the American Society for Metals.

He will continue as editor of subsequent volumes of the *Metals Handbook*, and will in addition have general editorial supervision of all ASM technical books.

Dr. Lyman received his A.B. degree in engineering at Stanford University in 1940, following with his master's degree in physical metallurgy from Harvard, 1941. He then earned his doctorate in metallurgy from the University of Notre Dame, 1944. He was an instructor in metallurgy at Columbia University, Illinois Institute of Technology and Notre Dame, and gained practical experience as a metallurgist at the Bendix Aviation Corporation during the latter part of World War II.

Joining the staff of American Society for Metals in 1945, he edited the 7th edition of the *Metals Handbook* and its 1954 and 1955 supplements. He also served on the staff of *Metal Progress*.

Publications Editor

Allen G. Gray has been appointed editor of periodical publications for American Society for Metals. While retaining editorship of *Metal Progress*, ASM's magazine of materials and process engineering, he will now have general editorial supervision of all society periodicals, including *Metals Review*, *Review of Metal Literature*, *Metals Engineering Quarterly* and *Transactions Quarterly*.

Dr. Gray's interests include both the aerospace-nuclear applications of metals and the down-to-earth, "everday" metals. He specialized in materials engineering and chemical aspects of metalworking and metal processing during 12 years of research and development with the duPont Company. His contributions to the nation's atomic energy development began during World War II when, on loan from duPont, he directed a group working on materials and corrosion problems for the Manhattan atomic bomb project at the University of Chicago.

Dr. Gray has also worked on

Continued on next page

Two Hardness Testers in a Single Instrument

Wilson "Rockwell" TwinTester

- The new Wilson Rockwell TwinTester combines in one instrument the functions of both a Rockwell and a Rockwell superficial hardness tester. Designed primarily for use in such areas as tool departments, maintenance repair shops and laboratories, the TwinTester offers many outstanding features.

Large direct-reading dial is marked with B and C scales for Rockwell hardness, and N and T scales for superficial Rockwell hardness readings. Just one zero set position for all scales.

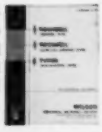
Easy to operate, the TwinTester can be changed from Rockwell to Rockwell superficial testing in seconds.

Complete equipment includes cowl, ball penetrator for B and T scales, Rockwell test blocks, anvils, dust cover and protective sleeve set.

A complete line of Wilson Rockwell instruments is available, including semi and fully automatic models.

Wilson "Brale" Diamond Penetrators Each diamond is cut to an exact shape. A comparator check and microscopic inspection of each diamond assure perfect readings every time.

Write for details—Ask for Catalog RT-58. It gives complete information on the Superficial tester as well as on the full line of Wilson Rockwell hardness testers.



WILSON "ROCKWELL" HARDNESS TESTERS

ACCO

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
230-R Park Avenue, New York 17, New York
For further information circle No. 71

ABOUT PEOPLE • • •

continued from preceding page

special assignment with General Electric at its Knolls Laboratory.

Receives SAMA Award

Carl S. Hallauer, Chairman of the Board, Bausch & Lomb, Incorporated, has again gained national recognition by being named recipient of the award of the Scientific Apparatus Makers Association. In conferring this high honor on one of B&L's top administrative officials,

more than 300 executives, representing 125 corporations across the nation, have singled him out as the scientific instrument industries' Man of the Year. Hallauer accepted the award on April 26, at the SAMA Conference, held at The Greenbrier, White Sulphur Springs, West Virginia.

In his presentation speech, SAMA President, Dr. George A. Downsbrough, underscored Hallauer's outstanding contributions to the industry, during more than a quarter of a century of active participation, first as a member and later, top executive officer of the Association. Having served as vice president and acting president, Hallauer became SAMA president in 1934, holding this position until 1936, when he became chairman of the board for one year. From 1938-1949 he was a director-at-large, and a member of several top policy committees.

Hallauer's career is legend in Rochester. Nothing indicates his phenomenal rise from boyhood poverty to industrial leadership more clearly than the Horatio Alger Award, presented to him a year ago.

Hallauer joined Bausch & Lomb in 1919, as manager of industrial relations. He became a vice president in 1935, and president of the company in 1954. In 1959, he was named chairman of the board.

Shown here are Hallauer, left, receiving the 1961 SAMA award from Dr. George A. Downsbrough, president of the organization.

Joins P.C.H.T. Staff

Louis E. Reilly has joined the staff of Pittsburgh Commercial Heat Treating Company. Reilly, formerly with the Bertrand P. Tracy Com-

Louis E. Reilly

pany, will serve as metallurgist for Pittsburgh Commercial. Reilly is a graduate of the University of Pittsburgh, and a director of the Smaller Manufacturers Council.

Unique General Alloys'

WROUGHT-CAST RADIANT TUBES

give consistent long life

General Alloys' combination *Wrought-Cast* Radiant Tube Assemblies give consistent long life because they combine a *cast* return bend with straight tubes made from *rolled and welded plate.*

This design utilizes the erosion resistance of the casting where it is most needed . . . at the return bend. The straight tube sections are fabricated from plate having a uniform wall section. These lightweight, dependable tubes save you fuel and maintenance dollars.

General Alloys Company is unique as a major producer of *both* castings and fabrications and therefore can recommend, without bias, the type of construction best suited for your needs.

For complete data, quotes, or engineering service contact the office nearest you . . . or write General Alloys Company, 390 West First Street, Boston 27, Massachusetts.

General Alloys Company also produces entirely cast, as well as entirely fabricated radiant tube assemblies, in all the heat resisting alloys for every purpose and in every size.

Ask about how our tube repair service can save you money!

GENERAL ALLOYS CO.

the only producer of both heat resisting castings and fabrications

GALLOYS

X-ite

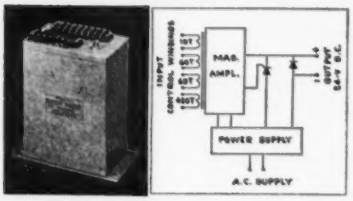
For further information circle No. 72

NEWS TO HEAT TREATERS...

New Electric Control

A combination magnetic amplifier and controlled silicon rectifier which combines a number of desirable features is available from Norbatrol Electronics Corp., Pittsburgh.

The new control serves as a static



relay for a thermistor, photocell, pressure transducer or other sensing element. Operating temperature range is -55 to +85 C. Four control windings permit comparison, addition or subtraction of input signals. The unit has no moving parts. It can also act as an on-off device in a control or indicating circuit and can serve as a regulator in a proportional system. Semiconductor elements are silicon type.

Optional order in the system includes additional control windings, internal voltage reference, choice of AC or DC output. The unit has a rating of 220 volts at 4 amps.

For further information circle No. 19

Sunbeam Appoints Rep.

Sunbeam Equipment Corporation, Meadville, Pennsylvania has appointed The Flarsheim Company, 647 West 39th Street, Kansas City 11, Missouri to represent the Sunbeam line of industrial heat treating furnaces and equipment in Western Missouri and Kansas.

For further information circle No. 30

Lindberg Markets TRV25

A new high temperature vertical graphite element furnace for operation to 5000 F. has been added to its line of equipment for production of semiconductors, solid state and other electronic devices by Lindberg Engineering Company, Chicago.

The manufacturer states that this Type TRV25-518 Lindberg Furnace is ideally suited for a wide variety of applications such as: calibration work on radiamatics, experimental studies of high temperature chemical reactions, firing of pyrolytic graphite and as an ex-

perimental tool for study of compression of material at elevated temperatures.

The graphite element is 5 in. I.D. by 18 in. high with a 6 in. effective work height at plus or minus 25 F. The bottom loading graphite work hearth is 4¼" O.D. and is raised and lowered by means of a hand wheel.

For further information circle No. 52

Steel Castings Summary Revised Edition Available

The Steel Founders' Society of America has announced publication of a revised edition of a Summary of Steel Castings Specifications.

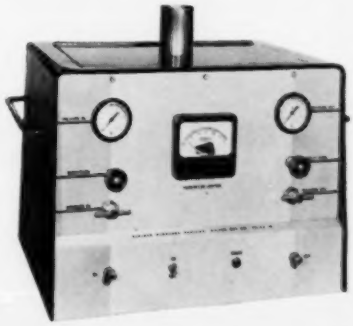
Prepared by the Specifications Committee of SFSA, the revision includes a major change in Federal Specification QQ-S-681. Several new classes have been added to specification A-296 and the property values have been changed on some classes in specifications A-297 and A-351. Two new methods of testing applicable to steel castings have been adopted and are included in the revised Summary.

Individual copies of the eight-page Summary may be obtained free of charge from SFSA members or by writing Steel Founders' Society of America, Cleveland 13, Ohio. The Summary may be purchased in quantity at 10¢ a copy.

For further information circle No. 29

Hydrogen Purifiers

A complete line of economical, easy to operate purifiers that produce ultra-pure hydrogen from impure hydrogen sources has been introduced by Milton Roy Company, Philadelphia. With this equipment, laboratories and industrial plants can now purify hydrogen in milliliters per minute or cu. ft. per hour quantities.



The Serfass Hydrogen Purifier was developed by Dr. Earl J. Serfass, formerly Head of the Department of Chemistry at Lehigh University and now Research and Development vice president for Milton Roy.

Ultra-pure hydrogen is needed for

Continued on next page

NEWS TO HEAT TREATERS

transistor and semi-conductor manufacturing, heat treating certain non-ferrous alloys, reduction of metal chlorides and oxides to form pure metals, preparation of metal hydrides, analytical techniques and other uses requiring the gas in pure form.

Shown here is the housing for 5, 15, 25 and 50 cfh models.

For further information circle No. 32

International Heat Transfer Conference Scheduled

Plans for a five day International Heat Transfer Conference, August 28 to September 1, 1961, at Boulder, Colorado, have progressed satisfactorily, according to Dr. A. C. Mueller, Chairman of the Joint Committee on North American Participation. The conference, sponsored by four engineering societies, two American and two British, with participation by eight others, will be held on the campus of the University of Colorado. Papers will be presented by engineers from the United States, Canada, England, U. S. S. R., Japan, Poland, Australia, France, Switzerland, Scotland, Sweden, Germany and Yugoslavia.

Dr. Mueller also noted that over one hundred papers on recent original work and new applications in heat transfer theory and practice will be reviewed by reporters and discussion of the papers will be emphasized. In addition, four lectures will review and synthesize recent developments in research and application. According to Dr. S. P. Kezios, Secretary of the Committee on North American Participation, discussion at the Boulder Conference will be continued at a special meeting in London, England in 1962 under the auspices of the Institution of Mechanical Engineers.

Registration information and advance programs may be obtained by writing to The American Society of Mechanical Engineers, Meetings Department, 29 West 39th Street, New York 18, New York. Advance registrants at the Boulder Conference will receive a bound copy of all papers before the meeting.

For further information circle No. 41

Fostoria Announces New Infrared Ovens

What is claimed to be a major breakthrough in the radiant energy heat ceiling was announced by R. H. Carter, president, Fostoria Corporation, during a recent meeting of the firm's regional sales managers at the Fostoria, Ohio plant.

According to Carter, new techniques, using fluid cooling, now make possible very compact quartz

YOU SPECIFY THE FURNACE...

wiretex will

FABRICATE THE FIXTURE

...Economically!

Wiretex incorporates advanced engineering techniques in fabricating parts holding fixtures to meet fast delivery on custom requirements. A wide range of sizes, types and alloys, for every type furnace.

Phone Wiretex First! Send for literature

Specialists in Processing Carriers Since 1932.

Wiretex mfg. co., 16 Mason Street, Bridgeport 5, Conn.

For further information circle No. 73

HEAT TREATMENT • • •

concluded from page 16

It was determined that a low temperature temper in the 300-400 F. range could be employed after the oil quench and prior to cold treatment without affecting the benefits derived from the cold treatment. For this reason a stabilization temper at 300 F. is recommended prior to the deep freeze.

A double two hour temper at 950 F. is recommended to develop maximum hardness. Figure 2 illustrates the tempering curves for Lesco BG41 austenitized at 2000 F., 2050 F., and 2100 F.

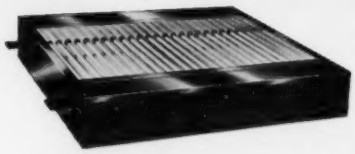
It should be noted that Lesco BG41 is only one of a series of 440-C modifications with which Latrobe is currently conducting development work. Lesco BG42 and Lesco BG43, consisting of 1% and 2% vanadium additions to the Lesco BG41 analysis, further improve the hot hardness properties and provide added wear resistance. These alloys employ heat treatment cycles similar to Lesco BG41, except that progressively higher austenitizing temperatures are recommended.

440 C. 1900 F., oil quench; 900 F. temper, 2 + 2 hours; -100 F. cold treat between tempers.

Lesco BG41. Hardened 2050 F., oil quenched; tempered 300 F., 1 hour; cold treated -100 F., 15 minutes; tempered 950 F., 2 + 2 hours.

Lesco BG42. Hardened 2100 F., oil quenched; tempered 300 F., 1 hour; cold treated -100 F., 15 minutes; tempered 975 F., 2+2 hours.

Lesco BG43. Hardened 2125 F., oil quenched; tempered 300 F., 1 hour; cold treated -100 F., 15 minutes; tempered 1000 F., 2 + 2 hours. • • •



lamp ovens and furnaces with extremely high heat transfer rates. Additional features claimed for this new equipment are precision control with no contamination during processing. Almost any shape of equipment may be fabricated to meet nearly any requirement for high temperatures, up to 3,000 F., or for short cycles.

The new developments are reported to hold special interest for metal processers for high speed finishing, annealing, brazing, porcelain enameling—for paper and textile industries in curing and drying high speed webs—for the printing industry in high speed ink drying—for the nuclear energy, electronics and space industries where ovens both clean and quick are imperative.

For further information circle No. 47

Conveyor Belting Line

A new line of heavy gage, hinged steel conveyor belting, with specially designed short-pitch belt links, is being marketed by the May-Fran Manufacturing Company, a division of Fischer & Associates, Inc. The new link design is compatible with existing conveyors using hinged steel belting. The shorter-pitch link

Continued on next page

ALL
THE BEST
HEAT RESISTING
ALLOYS
FROM STOCK
Stock List and Literature Available
ROLLED ALLOYS, INC.
Heat and Corrosion Resistant Alloy Specialists
5309 CONCORD AVE. DETROIT 11, MICH.
330 WILLIAM ST. SOUTH RIVER, N. J.

For further information circle No. 74

Continuous Heat Treating Depends on Continuous Product Flow and...

Aluminum piston heads flow on Ashworth Balanced Weave design B 60-38-14. It affords the required smooth surface characteristics to facilitate transfer and minimize product marking.

ASHWORTH KEEPS YOUR PRODUCT ON THE MOVE... CONTINUOUSLY!

In brazing, hardening, quenching, annealing, tempering, washing, sintering . . . any operation that demands continuous product flow . . . Ashworth Metal Process Belts can help you reduce handling and maintenance costs.

Ashworth Metal Process Belts can be fabricated from any metal or alloy . . . with any required surface characteristic. Skilled Ashworth Engineers have designed these belts to withstand and operate at temperatures up to 2100°F. Ashworth open mesh design permits circulation of processing atmosphere, or free drainage of process solutions in quenching, pickling and tempering.

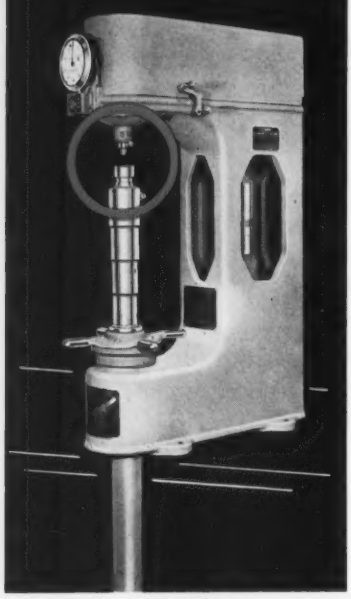
Engineering, plus accurate selection of wire analysis, plus careful fabrication insure quality woven into every Ashworth belt. You can depend on Ashworth to carry the load . . . continuously.

Consult your nearest Ashworth Sales Engineer or write directly to:

ASHWORTH BROS., INC.
WINCHESTER, VIRGINIA
Sales Offices In Principal Cities

For further information circle No. 75

GUARANTEED ACCURATE



The Most for Your "Rockwell Testing" Dollar!

Clark Hardness Testers are *guaranteed* accurate for all "Rockwell Testing". Clark's exacting workmanship in the production of penetrators, testing blocks, anvils, and other accessories pays off in exceptional accuracy on the job. No wonder the low cost surprises our first-time customers. *Clark Instrument, Inc., 10205 Ford Road, Dearborn, Mich.*

FREE REFERENCE BOOK

All information about hardness testing in easy-to-read text with many illustrations. Just write "Send Book" on your letterhead. Description and prices for Clark Hardness Tester and free Hardness Conversion Chart also available on request.

CLARK INSTRUMENT, INC.
10205 FORD ROAD
DEARBORN, MICHIGAN

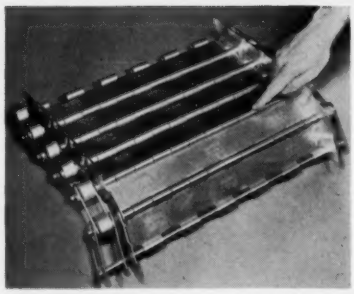
Missile-Age Accuracy

For further information circle No. 76

NEWS TO HEAT TREATERS

permits a considerable reduction in overall section depth of conveyor designs.

Developed for industrial conveyor applications where operating conditions are more rugged than normal, the heavier gage steel belting is assembled from May-Fran's patented-design hinged links. Fabricated from 1/8 in. thick steel, each individual belt link has a 2½ in. pitch. The shorter pitch allows the assembled hinged-steel belt to run on sprockets with a pitch diameter

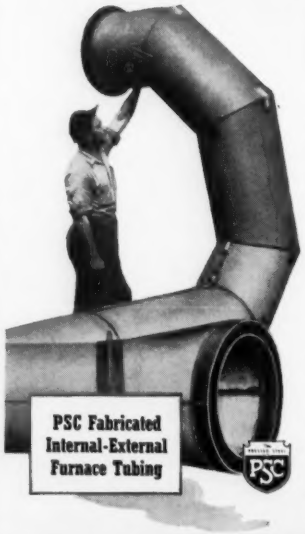


as small as 5 in. As a result, overall conveyor depth can be as little as 8½ in.

Hinged steel belting using these new links can be supplied in virtually any practical width. Individ-

for critical corrosive or heat conditions

SPECIFY 'PSC' PROCESS PIPING



You will find PSC offers you this very real advantage in solving heat and corrosion problems. Being independent of all metal producers, we regularly fabricate the complete list of alloys. As a result, when ordering welded tubing from PSC you can choose, from the complete list, the one alloy which will best meet your specific heat or corrosion condition. In contrast, seamless tubing is only available in certain alloys. From PSC you can also order tubing in any wall thickness. In many cases process piping can be lighter than I.P.S. standard. In some, only a light-wall type of construction is practicable. In any case, why pay for heavy wall sections if PSC tubing of money-saving light gauges will serve as well? Also tubing in any diameter or shape. Let us give you details as to how PSC process piping can help solve your problems.

THE PRESSED STEEL COMPANY
of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

☆ ☆ ☆ OFFICES IN PRINCIPAL CITIES ☆ ☆ ☆

For further information circle No. 77

ual links are produced in widths up to 18 inches. Belts wider than 18 inches are assembled simply by threading multiple links on the through rods.

The new belting was developed for handling materials such as nuts, bolts, stampings, castings, and other items which are not big physically, but are heavy in weight.

For further information circle No. 40

Patent Protection

Protection of patents in some foreign countries has long been a serious problem facing the American inventor, regardless of his field. This is especially true of the Soviet Union and its satellites, whose compliance with international laws leaves much to be desired.

There are, however, some steps which the American inventor of new methods and processes can take to protect his investments and assure reasonable compensation for his efforts.

A recently made available U. S. S. R. Official Bulletin of Patents and Inventions, translated into English, offers the inventor a guide of steps he can take to protect his interests. While not guaranteeing results, the book does present the basis for compliance with Russian patent laws.

For further information circle No. 53

Metals Handbook

The new ASM Metals Handbook which contains more than 2½ times as many pages on the selection and properties of metals as were in the 1948 edition is now available. The book offers nearly six times as much numerical information (as distinguished from descriptive text) in the form of charts, graphs, and tables. New emphasis has been placed on relating metals information to engineering and production practice. More first-hand examples and comparisons, a total of over 1,500, are included in the current volume—the first of a series that will ultimately cover all branches of metals engineering and metalworking. More than 1,300 metalworking specialists are named as contributors.

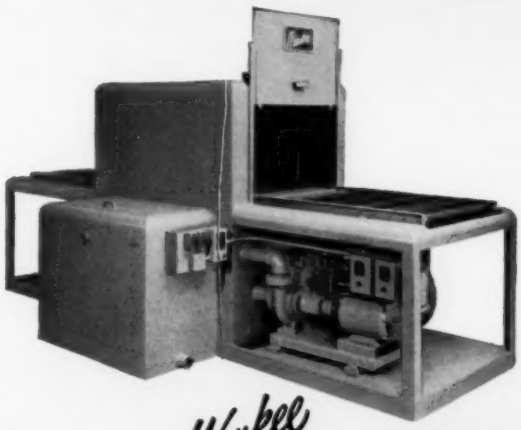
In addition to many highlights, such as the practical articles on selection of steel for economy in manufacturing and in machining, other major sections of the book cover carbon and low-alloy steels, cast irons, stainless steels and heat-resisting alloys, tool materials, nonferrous metals, and magnetic, electrical and other special purpose materials.

For further information circle No. 55

Magnaflux Introduces New Crack Locating Material

A complete, new family of materials for the wet method of visible and fluorescent magnetic particle

Old "Paste" Magnaglo method, left, and the new "Concentrates" method, right.



There's a standard Waukee® WASHER
TO MATCH YOUR CARBONITRIDER OR CARBURIZER!

Whatever the size of your carbonitrider or carburizer, the new Waukee Washer has a standard size to match it. Size range: 24 x 36 x 18 — 24 x 48 x 24 — 30 x 48 x 24 — 36 x 48 x 24.

COMPLETE — NO "EXTRAS" — Waukee parts washers come to you complete, ready to locate, connect to utilities, and begin operation. No "extras" to buy and install. Pumps, burners, controls are designed as integral parts of the Waukee Washer. You use your present furnace work-baskets, too.

FLEXIBILITY — You gain in flexibility with Waukee Washers. Standard units are available in "in-and-out" feed or straight-through, conveyor type, and in one, two, or three stages with rinse and dry. High-efficiency with gas, electricity, or steam.

THOROUGH CLEANING — The smallest Waukee Washer sprays a minimum of *one ton of hot detergent solution through the load each minute.* Solution penetrates work basket from top and bottom, washes away oil and foreign matter from the densest charge. Bull's-eye timer cycles the load for complete washing without guesswork or waste of time.

Complete data in Bulletin 1201 — write for it today.

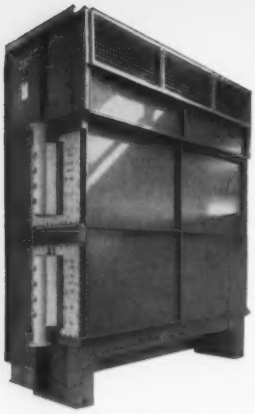
Waukee-washed parts are free of cutting and quenching oils, mean clean furnace atmospheres, therefore predictable case depths and cleaner, brighter work.

Waukee ENGINEERING CO.

5137 N. 35TH ST., MILWAUKEE 9, WIS.

MAKERS OF WAUKEE GAS FLO-METERS • MIXORS • COMPRESSORS

For further information circle No. 78



You Get Better Results IN HEAT TREATING!

● Use the NIAGARA AERO HEAT EXCHANGER to control the temperature of your quench bath and you remove the heat *at its rate of input,* always quenching at the exact temperature that will give your product the best physical properties.

The Niagara *Aero* Heat Exchanger transfers the heat to atmospheric air by evaporative cooling. It extends your quenching capacity without using extra water. It pays for itself with water savings.

You can cool and hold accurately the temperature of all fluids, gases, air, water, oils, solutions, chemicals for processes and coolants for mechanical and electrical equipment. You get closed system cooling, free from dirt and scale.

Write for Bulletins 120, 124, 132

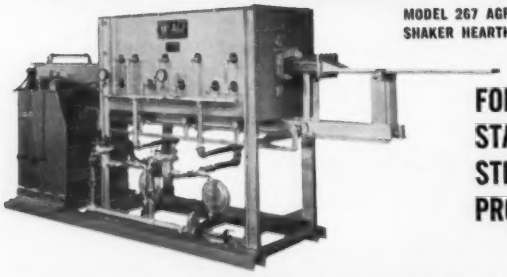
NIAGARA BLOWER COMPANY

Dept. MG-6, 405 Lexington Ave., New York 17, N. Y.

District Engineers in Principal Cities of U. S. and Canada

For further information circle No. 79

AGF AUTOMOTION



MODEL 267 AGF AUTOMOTION SHAKER HEARTH FURNACE.

FOR STAINLESS STEEL PARTS PROCESSING

A G F Shaker Hearth Furnaces, employing the "Work In Motion Principle", bright anneal and harden up to 100 lbs. of stainless steel parts per hour at temperatures up to 2000° F. Uniform atmosphere throughout the processing cycle is assured by the full seal construction of the muffle. Fully automatic processing from start to finish eliminates all guess work and timing by the operator. Low cost, low operation expense, ease of operation and maintenance,and dependable, reliable performance are good reasons to make an A G F Shaker Hearth Furnace your next installation.

Write today for complete details . . . Ask for Catalog MT-607.

AMERICAN GAS FURNACE CO. 1004 LAFAYETTE STREET, ELIZABETH, N. J.

For further information circle No. 80

NEWS TO HEAT TREATERS

testing is now being introduced by Magnaflux Corporation, Chicago. This major development is the result of concentrated and continual research of a proven test method and magnetic particle pastes used throughout industry for over 30 years to locate invisible cracks in ferrous material and parts.

The new materials, called concentrates, are all in powder form and incorporate features said to be superior to the previous Magnaflux and Magnaglo pastes. They are: easier mixing, handling, and storage, a measurable increase in fluorescent brilliance from 70% to 600%, closely controlled particle size range, less foaming, and more corrosion protection.

The complete family consists of eight different materials—four for the visible red or black Magnaflux method and four for the more sensitive fluorescent Magnaglo method. Certain concentrates are formulated specifically for oil suspensions, others for water. Each has different characteristics related to particle size, magnetic properties, color contrast and concentrations. This variety is reported to afford a choice of the optimum material for any given testing situation.

Laboratory and field tests show that preparation of the new materials is considerably faster than the old method.

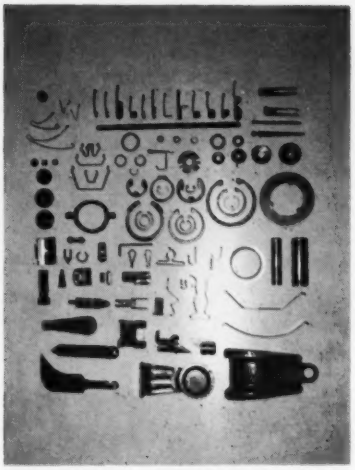
For further information circle No. 46

New Plant — Greater Capacity for Heinzelman

Fred Heinzelman and Sons, Inc., after more than forty years of commercial heat treating in downtown New York City, have moved to Carlstadt, New Jersey, adjacent to the Teterboro Airport. The new plant designed to meet the accuracy and requirements of precision heat treating, is one of the few heat treating companies with complete Kleissler Fume and Dust Exhaust

control, and Wallace and Tiernan industrial waste water purification systems in accordance with the State Board of Health requirements.

In full operation the last several months, the plant has a new atmosphere controlled double hearth automation shaker furnace which was



featured on the cover of the April-May issue of METAL TREATING. The continous wash, dry, and tempering unit in line with the hardening furnace assures consistent accurate control of hardness and physical specifications. This machine, in addition to an atmosphere controlled single hearth unit, permits processing of both small and large lots of the widest variety of parts on a production basis.

Pictured here are a few of the representative samples treated in the new facility.

For further information circle No. 2

Receives Furnace Contract

Amsler Morton Company, Pittsburgh, Pa., has received a contract from Bethlehem Steel Company to design and erect three carburizing and nitriding furnaces and one car type furnace at its Bethlehem, Pennsylvania, works.

The carburizing and nitriding furnaces will be capable of carburizing a 7,000 pound charge at a maximum temperature of 1900 F. or for nitriding at temperatures of approximately 1050 F.

For further information circle No. 50

DIAL IN ON GREATER TEMPERATURE CONTROL ACCURACY!

"Pin-point" accuracy is at your fingertips with West's new tubeless, solid-state digital set point controllers. By adjusting the 3-digit, 1000-unit dial, the control point can be set in increments (depending on range) as small as ½°. Null balance circuit provides exceptional sensitivity . . . closer than ¼° with most thermocouples.

Calibration is not affected by leadwire length. Continuous cold junction compensation is provided electrically. Repeatability, linearity and resolution are excellent.

These compact units may be panel or surface-mounted. Available in on-off, proportioning and stepless (saturable core reactor) control modes . . . one, two or three ranges can be provided. For full details, write for Bulletin JY.

NEW DIGITAL SET POINT CONTROLLERS ...by WEST

WEST Instrument CORPORATION
SALES OFFICES IN PRINCIPAL CITIES
FACTORY AND GENERAL OFFICES
4357AA W. Montrose, Chicago 41, Ill.
WEST INSTRUMENT, LTD.
52 Regent St., Brighton 1, Sussex

For further information circle No. 81

MANUFACTURERS' LITERATURE

For your copy circle the number on the Readers' Service Card

Publication of a new technical booklet, **"Tool Components and Their Applications,"** has been announced by PIC Design Corp. The new 24 page booklet, sixth in PIC's current series was prepared to give the designer and engineer a clearer concept of standardized tool components and their varied applications. Case histories, citing specific examples, cover their use as standard parts for jigs, fixtures, tools and dies. Fully illustrated, the new booklet points up the advantages and the savings effected in design and machine shop time, by the use of these standardized tool components. Copies of the new booklet are available, without charge.

For further information circle No. 17

A number of data sheets which will be of interest to many readers are available from Heppenstall Company. Characteristics and general applications are outlined in each of data sheets: *Heppenstall Grade C57*—Tradenames "Pyrotem" and "Pyroneal"

For further information circle No. 62

Tradenames "Thermotem-10" and "Thermoneal-10"

For further information circle No. 63

Tradenames "Thermotem-11" and Thermoneal-11" Heppenstall grade H722

For further information circle No. 64

Tradenames "Thermotem-12" and "Thermoneal-12" Heppenstall grade T721

Tradenames "Thermotem-13" and "Thermoneal-13" Heppenstall grade H720

For further information circle No. 66

Tradenames Super Pyrotem and Super Pyroneal Heppenstall Grade C58

For further information circle No. 67

Tradename Super Hardtem—Heppenstall Grade 3C40

For further information circle No. 68

Tradenames "Semdex" Trimmer Steel and "S" Treated and "S" Annealed Die Steel—Heppenstall grade 14A60

All sheets include heat treating data.

For further information circle No. 69

"Three Keys to Satisfaction," a 77 page revised guide to combining sound design principles, proper selection of steels and good heat treatment to achieve optimum economy and material performance, is now available from Climax Molybdenum Company. Separate sections on design, steels and heat treatment, amply illustrated with tables and charts, contain basic information which it is said make it possible for fabricators to increase the endurance limit of properly selected steels fivefold when good heat treatment practices are applied, and increase the endurance limit of properly selected steels tenfold when both sound design principles and good heat treatment practices are combined.

For further information circle No. 18

A 16-page technical instruction bulletin describing the company's nickel sulfamate process has been released by Hanson-Van Winkle-Manning Company. Four important features of the nickel sulfamate process are: mechanical properties of deposits are controllable; the liquid concentrate solution is chloride free; solution is premixed—no dry chemicals to dissolve, except nickel chloride, when desired. The bulletin illustrates, with micro-photographs and charts, and completely describes solution preparation for both still and barrel operations, effects on deposits of using various proportions of solutions constituents, effective temperatures and densities and voltage requirements. Also discussed are purification methods, analytical procedures for constituents, equipment and materials needed to successfully operate the nickel sulfamate bath.

For further information circle No. 13

A two page bulletin describing their complete line of laboratory hot plates has been prepared by the Laboratory Equipment Division, Lindberg Engineering Company. Six different sizes of electric hot plates all incorporating stepless control covering the temperature range 120 F. (49 C.) to 950 F. (500 C.) are fully described. These include both portable and permanently installed units.

For further information circle No. 23

An eight page guide to the most economical method of purchasing high alloy castings is available from the Alloy Casting Institute. Titled "How to Buy High Alloy Castings", the article was written by Mr. E. A. Schoefer, ACI executive vice president. Schoefer offers five rules to help the buyer obtain the best value when ordering high alloy castings: Specify alloys by casting type; give service conditions and specifica-

tions; give complete dimensions and detailed drawings; use good pattern equipment; establish realistic delivery requirements. Each rule is fully discussed, giving typical questions that should be answered by the purchaser. Included in the article is a complete chart of standard designations and chemical composition ranges for heat and corrosion resistant castings.

For further information circle No. 12

The Cobalt Information Center has announced publication of its comprehensive, new *Cobalt Monograph*. This 515 page reference source presents available data on the physical, chemical, and mechanical properties of the element, provides detained studies of the alloy systems, and reviews present and potential applications.

An extensive table of contents, which serves also as index, lists the book as dealing primarily with the following topics: history, mining, extractive metallurgy, economics, physical and mechanical properties, chemistry, alloy systems, high-temperature alloys, magnetic materials, tool and die steels, cemented carbides, hard-facing and wear-resistant alloys, coatings, other industrial alloys, glass and ceramics, catalysts, driers, and pigments, Co_{60}, agriculture, and medical aspects. The chapters include 185 figures and 105 tables and close with a comprehensive bibliography through 1958. More than 1,200 references are cited through the book.

The book was edited by the staff of the Centre d'Information du Cobalt, Brussels, Belgium. It is published in English and sells for $15.00 or 750 francs.

For further information circle No. 26

Materials for Advance Technology is a handy data packet, an eight page, two-color roundup on 12 new products from Carborundum Company's Research and Development Division. The materials described offer important opportunities for improved design and performance in applications requiring resistance to abrasion, chemicals, corrosion, nuclear radiation, and high temperatures.

For further information circle No. 15

Series "ZB" nozzle-mixing, buried blast burners are described in a new four page Bulletin No. H-42 from the Combustion Division, Eclipse Fuel Engineering Co., Rockford, Illinois. Nine burner sizes are listed in a choice of 54 maximum firing capacities from 60,000 to 14,500,000 Btu/hr. "ZB" burners are designed for sealed or tight combustion chamber applications such as ceramic firing, process heating, ferrous and nonferrous metal melting or heat treating, billet heating, and other processes. Concentric design of separate air and gas ports is said to prevent backfiring and permit virtually limitless turndown from high firing. Due to this design they may also be used in very high temperature applications with preheated combustion air and/or oxygen enriched air. Typical "ZB" burner installation diagrams illustrate the wide range of applications possible. Selection and sizing information, including dimensions and specifications, permit ordering burners directly from the bulletin.

For further information circle No. 3

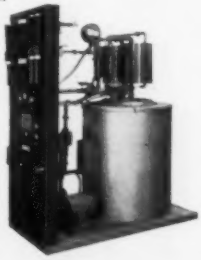
ROLOCK®

ATMOSPHERE EQUIPMENT

• *NEWEST and most advanced engineering*
• *important NEW aids to quality control*
• *coordinated systems and equipment*

ROLOCK CARBON POTENTIAL CONTROLLER
- Accurately controls carbon potential of furnace atmospheres (not by dewpoint).
- Immediate and constant response.
- Precise and dependable control.
- Minimum maintenance.
- Specially trained operators not required.

U.S. Patent No. 2,818,246 (Kappel)



ROLOCK ENDOTHERMIC GAS GENERATORS
- Complete reversibility and self-cleaning of catalyst beds.
- Precise gas-air metering and mixing.
- Dual Catalyst chambers . . . complete cracking.
- Stainless cooling coils prevent reverse action.
- Compact, easily installed "packaged" unit.

U.S. Patent No. 2,802,725 (Kappel)

ROLOCK AMMONIA DISSOCIATOR
- Same high standards of efficiency and performance as the Endothermic Gas Generator.
- Dual purpose heat exchangers and twin catalyst chambers keep residual ammonia to an absolute minimum.

For technical literature, write:

ROLOCK INC., 1332 KINGS HIGHWAY, FAIRFIELD, CONN.

JOB-ENGINEERED for better work
Easier Operation, Lower Cost

1RL6TBR

For further information circle No. 82

STAINLESS STEEL SLICING MACHINE BLADES

are precision

edge-hardened

in 30 seconds

Unique Fixturing designed by Induction Heating Corporation of Brooklyn, New York, makes it possible to harden stainless steel slicing machine blades in a few seconds without warpage and with only minor finishing needed.

IT IS AN ALMOST impossible job to prevent distortion and warpage in circular cutter blades when heat treating them—almost. So that anyone who can devise a system that does do the onerous job and does it on a production line basis, can literally write his own ticket. Induction Heating Corporation engineers have done precisely that. As a result, follow up grinding operations no longer are needed to eliminate warpage, and finishing time has been reduced to a realistic level.

To harden stainless steel, very high temperatures are needed. Ther-Monic's engineers get the necessary 2000 F. heat by employing a standard 25 KW (Model 2500) generator.

Because the heat pattern itself is unique, IHC had to design a work coil that would insure an even heat zone across the narrow 15/16 in. width of the hardened area. The fact that the edge of the disc increased in thickness from edge to center hole of the cutter also had to be taken into account.

To accommodate the machine to the job, IHC engineers designed a two position setup. The left portion (as shown in the picture) shows the circular stainless steel cutter blade positioned over the special Ther-Monic work coil which brings the disc rapidly up to hardening temperature of 2000 F. Thirty seconds after loading the part is taken from the work coil and is transferred to the special device shown at the right.

That device is essentially a quench station designed to prevent the distortion and warpage which normally would follow heat treating of circular cutter blades by any other method. It works in this way:

When the hot blade is transferred to it, the quench dies are moved into position and air under pressure rapidly cools the blade to a level where water cooled quenching can take over. Meanwhile, the quench dies are designed to hold the cutter blade in proper position. When the hardening operation is complete, the blade is still flat and true.

Actuating mechanism for the dies is a hydraulic cylinder. It forces the upper quench plate down onto the hot blade and the lower quench block. Application of pressure keeps the blade straight during the entire cooling period. In this way the blades are perfectly hardened, the hardness is uniform over the entire wear surfaces, and the original high quality of the blades is retained.

Induction Heating Corporation has had to harden all kinds of cutters and blades in the past, from beet knives and slitting knives to 72 in. diameter circular saws, some of which did involve problems in warpage. But none presented the difficulties encountered in this precision heat hardening of stainless steel slicing machine blades. • • •

Heat Treating

Case Histories

— Case No. 6

1961 WESTERN METAL SHOW • • •

continued from page 19

metals was conceived more than a quarter century ago, it was only during the past decade that detailed knowledge has been available on dislocation behavior. We are, however, beginning to understand what really happens in metal crystals to cause creep, fatigue, and brittle fracture."

E. D. Weisert, Metallurgy Group Supervisor for Marquardt Corporation, Van Nuys, California, stressed the growing importance of refractory metals for use in structures which must operate at temperatures exceeding 2000 F.

"Investigations to date have only begun to scratch the surface of possibilities," he stated. "But the promise of highly desirable engineering benefits has stimulated a relatively intense effort in the refractory metals field."

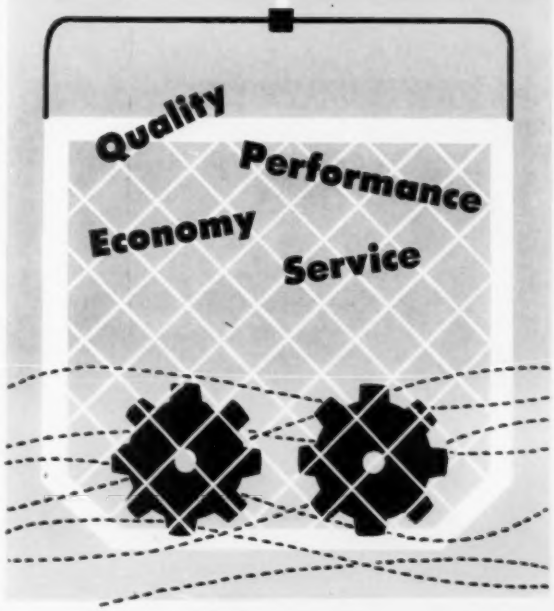
Among the more interesting products which were exhibited at the show was a tiny transistorized constant phase control unit which provides exact microsecond regulation of power output and operating temperatures for electric furnaces and other heating systems. Introduced by C. I. Hayes, Inc., this 7 in. by 9 in. by 3 in. unit is said to cost only a fraction as much as comparable control devices and to save up to 75% of the space normally required for electronic tubes, magamps, reactors, and powerstats which serve the same general purpose.

Hayes also exhibited a new high frequency induction heating unit featuring compact construction and fully automatic controls—a device which is believed to be

concluded on page 44

"CHECK THE SPECS!--IT'S THE HEAT TREATMENT CALLED FOR."

HEATBATH SALT BATHS FOR



on all Heat Treating Jobs

CARBURIZING • QUENCHING • ANNEALING • NEUTRAL HARDENING • NITRIDING • BRAZING • TEMPERING • DESCALING • MARTEMPERING • HIGH-SPEED HARDENING

HEATBATH CORPORATION

SPRINGFIELD 1, MASSACHUSETTS

or 701 North Sangamon St., Chicago 22, Ill.

39 Years of Service to the Heat Treating and Metal Finishing Industry

For further information circle No. 83

Request literature on complete line of Huppert furnaces and ovens.

Be sure of Maximum Heat Treating Efficiency with

HUPPERT FURNACES

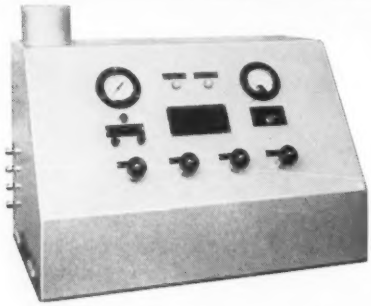
- Range: 300° F. to 2000° F.
- High temperature, heavy-duty Kanthal elements
- Multi-insulation
- Counter-weighted, tight-sealing door
- Operational pilot light
- Shipped ready to operate

Model No.	Inside Dimensions			KW	Prices 220 Volt Single Phase	
	Wide	High	Deep		With Huppert Input Controller	With Electronic Temp. Controller
869	8"	6"	9"	4	$296.00	$480.00
11*	8"	6"	12"	4	306.00	518.00
12*	8"	8"	12"	6	382.00	590.00
12A*	8"	8"	18"	9	490.00	698.00

*For 2300° F. add $95.00 to No. 11 and No. 12, and $105.00 to No. 12A. No. 12A can be furnished for 3 phase at no additional cost. For floor model add $52.00 to above prices. No. 869 standardly supplied for 2200°F.

K. H. HUPPERT CO.
Manufacturers of Electric Furnaces and Ovens
6849 Cottage Grove Ave., Chicago 37, Illinois

For further information circle No. 84



ENGELHARD HYDROGEN DIFFUSION PURIFIER

This Hydrogen Purifier removes all impurities (including oxygen, nitrogen, argon, water vapor, hydrocarbons, etc.) from hydrogen gas streams. Produces hydrogen of highest purity obtainable from dissociated ammonia, steam reformed natural gas or propane, commercial hydrogen purchased in cylinders and other hydrogen containing gas streams. *No trace of impurities detectable in purified gas.* Ultra-pure product hydrogen obtained at lowest cost. • Available in standard sizes: 100 c.c. per hour, 20 SCFH, 75 SCFH, and 150 SCFH. Larger sizes custom built to requirements. Write for literature.

ENGELHARD INDUSTRIES INC — INDUSTRIAL EQUIPMENT DIVISION
GAS EQUIPMENT SECTION
113 ASTOR STREET • NEWARK, N. J.

For further information circle No. 85

1961 WESTERN METAL SHOW • • •

concluded

unique in that its heater stations and power supply generator are incorporated into a single space saving floor console.

The National Carbon Company Division of Union Carbide Corporation, New York, displayed specimens of its new graphite cloth materials which are finding important new applications as resistance heating elements for high temperature brazing.

Durak-B, a coating product that forms a mixture of refractory intermetallic compounds for the prevention of oxidation in molybdenum alloys at temperatures of 1400 F. or more, was exhibited by Chromizing Corporation, Hawthorne, California.

Pictured on page 18, are a number of the outstanding displays which typified the Twelfth Western Metal Exposition and Congress. • • •

FURNACE ATMOSPHERE ANALYZER — CONTROLLER • • •

concluded from page 23

peak of the four being analyzed while simultaneously recording the regular bar graph of all components. The remembered peak value is then available as a signal to the balance of the control system.

The Peak Picker automatically transduces any variation from the desired percentage of CO_2 into a 3 to 15 psig pneumatic signal, which is transmitted to the twin valve arrangement. Air-motor positioners open the valves so they add the proper quantity of air or methane to the furnace atmosphere.

A Second Analyzer

Impressed with the results obtained by installing the chromatographic furnace analyzer on the gantry furnace, Commercial recently purchased a second Perkin-Elmer analyzer. This is a portable instrument with a 10 minute analysis cycle. Its most common use is in the monitoring of Commercial's endothermic and other gas generators, where it enables complete analysis of CO_2, CH_4, N_2, and CO.

As still a further refinement of the analyzer, the company expects to equip it with a new Perkin-Elmer column modification that adds moisture analysis capabilities. This will permit reading of moisture content in concentrations as high as 25% by volume.

Aside from its effectiveness in heat treating applications, the furnace analyzer also shows promise in many related areas. It is presently in experimental use on a large sintering furnace. Other uses contemplated include open hearth and blast furnaces. • • •

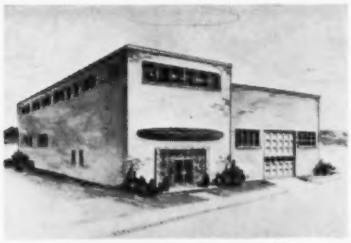
NEWS TO HEAT TREATERS

General Vacuum Moves

General Vacuum Corporation, formerly located in East Boston, Massachusetts has moved to a modern new multi-story building at Medford, Massachusetts.

The new plant is specially designed for the company's activities, which include the design and manufacture of high vacuum systems. The manufacturing area includes a high-bay area equipped for assembly and test of very large systems.

General Vacuum Corporation is rapidly growing as a leading pro-



ducer of custom engineered high vacuum systems. These systems all take advantage of the ultra-purity of high vacuum and are used by the producers and fabricators of refractory, reactive, and nuclear metals. They are also used for brazing, sintering, welding and coating many products formerly produced in controlled atmospheres.

Systems are supplied to the aerospace and electronics industry as space simulators and for special applications for manufacturing and evaluating components for missiles and rockets and for developing outer space propulsion engines.

Shown here is an architect's drawing of the new facility.

For further information circle No. 36

Low Temp Heat

Catalytic Combustion Corporation has announced a revolutionary development in the field of infra-red heating—a completely controllable, flameless, catalytic method of producing low temperature infra-red heat. These new units are reported to be suitable for a wide variety of heat transfer requirements, including baking, drying, curing, bonding, preheating, softening, and evaporating.

For the first time, complete and accurate infra-red source temperature control is available. Surface temperature of the catalyst screen can be held automatically at any point between 800 F. and 1500 F. by proportionate control of the gas flow.

Catalytic I-R heating panels are available in standard sizes, and are readily adaptable for mounting and grouping. Panels are designed to provide heat release rates between 2,000 and 12,000 BTU per hour per sq. ft. of emission surface. This is approximately equivalent to a range of 4 to 24 watts per sq. in.

For further information circle No. 22

New Location New Building

Metallurgical Consultants, Inc. has moved into its new building at 8100 East Slauson Avenue, Montebello, California.

The one story concrete building contains 12,000 sq. ft. for plant and office purposes, including a 4,000 sq. ft. furnace room.

Major new equipment now being installed includes an integrated series of six bases designed by MCI engineers for one of the high temperature brazing furnaces. Each base will be equipped with a retort of its own.

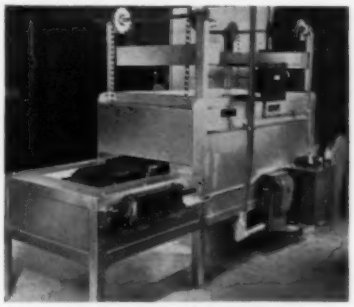
By rotating the bell-type furnace from base to base with only momentary interruptions between jobs, it will be possible to keep the unit in almost continuous use and step up its production rate threefold.

For further information circle No. 45

Compact Waltz Unit Heats Small Slugs

A small compact production furnace designed and built to heat various small brass slugs for forging is being marketed by Waltz Furnace Company, Cincinnati.

The furnace is electrically heated and features a continuous mesh belt. As slugs are heated in the furnace, the belt carries them out the discharge end, to a forging press. Since this is a simple heating operation, no atmosphere is provided by the furnace.



The unit is set up off the floor and is supported by four legs, permitting easy installation and positioning in most existing shop spaces. It is set up for 3-phase, 440 volt, 60 cycle operation, and draws about 50 KW. Power housing unit, and control panel are mounted on the side of the furnace.

Doors on the entry and exit end of the furnace are raised and lowered by means of the chain and sprocket arrangement supported by uprights above the heating chamber of the furnace. When closed the doors leave adequate clearance for slugs being continually passed into the furnace on the conveyor.

For further information circle No. 48

Metal Treating
THE ONLY MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

EQUIPMENT AND

AMMONIA STORAGE EQUIPMENT

C. I. HAYES, INC.
816 Wellington Avenue
Cranston 10, Rhode Island

CARBURIZING COMPOUNDS

PARK CHEMICAL COMPANY
8074 Military Avenue
Detroit 4, Michigan

CONVEYOR BELTS

ASHWORTH BROS., INC.
Winchester, Virginia

THE INTERNATIONAL NICKEL CO., INC.
67 Wall Street
New York 5, New York

DISSOCIATORS, AMMONIA

GENERAL ELECTRIC COMPANY
INDUSTRIAL HEATING DEPARTMENT
One Progress Road
Shelbyville, Indiana

ROLOCK, INC.
1332 Kings Highway
Fairfield, Connecticut

EVAPORATIVE COOLING

NIAGARA BLOWER COMPANY
405 Lexington Avenue
New York 17, New York

FABRICATION
(Heat & Corrosion Resistant)

BERLIN CHAPMAN CO.
Berlin, Wisconsin

GENERAL ALLOYS COMPANY
390 West First Street
Boston 27, Massachusetts

IPSEN INDUSTRIES, INC.
715 South Main Street
Rockford, Illinois

THE PRESSED STEEL COMPANY
Wilkes-Barre, Pennsylvania

ROLOCK, INC.
1332 Kings Highway
Fairfield, Connecticut

STANWOOD CORPORATION
4825 West Cortland Street
Chicago 39, Illinois

WIRETEX MFG. CO., INC.
16 Mason Street
Bridgeport 5, Connecticut

FIXTURES

AJAX ELECTRIC COMPANY
940 Frankford Avenue
Philadelphia 23, Pennsylvania

ALLOY ENGINEERING COMPANY
70 Sheldon Road
Berea, Ohio

BERLIN CHAPMAN CO.
Berlin, Wisconsin

GENERAL ALLOYS COMPANY
390 West First Street
Boston 27, Massachusetts

THE INTERNATIONAL NICKEL CO., INC.
67 Wall Street
New York 5, New York

ROLLED ALLOYS, INC.
5309 Concord Avenue
Detroit 11, Michigan

ROLOCK, INC.
1332 Kings Highway
Fairfield, Connecticut

STANWOOD CORPORATION
4825 West Cortland Street
Chicago 39, Illinois

WIRETEX MFG. CO., INC.
16 Mason Street
Bridgeport 5, Connecticut

FLAME HARDENING

META-DYNAMICS DIVISION
THE CINCINNATI MILLING
MACHINE COMPANY
4701 Marburg Avenue
Cincinnati 9, Ohio

DETROIT FLAME HARDEN.NG CO.
17644 Mt. Elliott Avenue
Detroit 12, Michigan

SELAS CORPORATION OF AMERICA
Dresher, Pennsylvania

FLOW MEASUREMENT

AMERICAN GAS FURNACE CO.
808 Lafayette Street
Elizabeth, New Jersey

SELAS CORPORATION OF AMERICA
Dresher, Pennsylvania

WAUKEE ENGINEERING CO.
5137 North 35th Street
Milwaukee 9, Wisconsin

FURNACES

AMERICAN GAS FURNACE CO.
808 Lafayette Street
Elizabeth, New Jersey

THE ELECTRIC FURNACE CO.
Salem, Ohio

GENERAL ELECTRIC COMPANY
INDUSTRIAL HEATING DEPARTMENT
One Progress Road
Shelbyville, Indiana

C. I. HAYES, INC.
816 Wellington Avenue
Cranston 10, Rhode Island

CHARLES A. HONES, INC.
Baldwin, L. I., N. Y.

IPSEN INDUSTRIES, INC.
715 South Main Street
Rockford, Illinois

LINDBERG ENGINEERING COMPANY
2466 West Hubbard Street
Chicago 12, Illinois

PACIFIC SCIENTIFIC COMPANY
P. O. Box 22019
Los Angeles 22, California

SELAS CORPORATION OF AMERICA
Dresher, Pennsylvania

THE SENTRY COMPANY
62 Main Street
Foxboro, Massachusetts

FURNACES (Salt Bath)

AJAX ELECTRIC COMPANY
940 Frankford Avenue
Philadelphia 23, Pennsylvania

AMERICAN GAS FURNACE CO.
808 Lafayette Street
Elizabeth, New Jersey

CHARLES A. HONES, INC.
Baldwin, L. I., N. Y.

LINDBERG ENGINEERING COMPANY
2466 West Hubbard Street
Chicago 12, Illinois

FURNACES (Vacuum)

GENERAL ELECTRIC COMPANY
INDUSTRIAL HEATING DEPARTMENT
One Progress Road
Shelbyville, Indiana

C. I. HAYES, INC.
816 Wellington Avenue
Cranston 10, Rhode Island

IPSEN INDUSTRIES, INC.
715 South Main Street
Rockford, Illinois

LINDBERG ENGINEERING COMPANY
2466 West Hubbard Street
Chicago 12, Illinois

PACIFIC SCIENTIFIC COMPANY
P. O. Box 22019
Los Angeles 22, California

MATERIALS DIRECTORY

Metal Treating
THE ONLY MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

GAS BURNERS & TORCHES

CHARLES A. HONES, INC.
Baldwin, L. I., N. Y.

GAS GENERATORS

AMERICAN GAS FURNACE CO.
808 Lafayette Street
Elizabeth, New Jersey

ENGELHARD INDUSTRIES, INC.
113 Astor Street
Newark, New Jersey

GENERAL ELECTRIC COMPANY
INDUSTRIAL HEATING DEPARTMENT
One Progress Road
Shelbyville, Indiana

C. I. HAYES, INC.
816 Wellington Avenue
Cranston 10, Rhode Island

IPSEN INDUSTRIES, INC.
715 South Main Street
Rockford, Illinois

LINDBERG ENGINEERING COMPANY
2466 West Hubbard Street
Chicago 12, Illinois

PACIFIC SCIENTIFIC COMPANY
P. O. Box 22019
Los Angeles 22, California

ROLOCK, INC.
1332 Kings Highway
Fairfield, Connecticut

GAS MIXING EQUIPMENT

WAUKEE ENGINEERING CO.
5137 North 35th Street
Milwaukee 9, Wisconsin

HARDNESS TESTERS

CLARK INSTRUMENT, INC.
10200 Ford Road
Dearborn, Michigan

WILSON MECHANICAL INSTRUMENT DIV.
AMERICAN CHAIN & CABLE COMPANY, INC.
230 Park Avenue
New York 17, New York

HEAT EXCHANGERS

NIAGARA BLOWER COMPANY
405 Lexington Avenue
New York 17, New York

HEATING ELEMENTS (Non-Metallic)

THE CARBORUNDUM COMPANY
P. O. Box 339
Niagara Falls, New York

INDUCTION HARDENING

META-DYNAMICS DIVISION
THE CINCINNATI MILLING MACHINE COMPANY
4701 Marburg Avenue
Cincinnati 9, Ohio

METAL FINISHING

HEATBATH CORPORATION
P. O. Box 78
Springfield 1, Massachusetts

METALS, SPECIAL

BETHLEHEM STEEL COMPANY
Bethlehem, Pennsylvania

THE INTERNATIONAL NICKEL CO., INC.
67 Wall Street
New York 5, New York

ROLLED ALLOYS, INC.
5309 Concord Avenue
Detroit 11, Michigan

PROTECTIVE COATINGS

PARK CHEMICAL COMPANY
8074 Military Avenue
Detroit 4, Michigan

QUENCH BATH TEMPERATURE CONTROLS

NIAGARA BLOWER COMPANY
405 Lexington Avenue
New York 17, New York

QUENCHING OILS

PARK CHEMICAL COMPANY
8074 Military Avenue
Detroit 4, Michigan

SHELL OIL COMPANY
50 West 50th Street
New York 20, New York

SUN OIL COMPANY
INDUSTRIAL PRODUCTS DEPARTMENT
Philadelphia 2, Pennsylvania

RADIANT TUBES

THE PRESSED STEEL COMPANY
Wilkes Barre, Pennsylvania

REFRACTORIES

THE CARBORUNDUM COMPANY
P. O. Box 268
Perth Amboy, New Jersey

SALTS (Heat Treating)

PARK CHEMICAL COMPANY
8074 Military Avenue
Detroit 4, Michigan

HEATBATH CORPORATION
P. O. Box 78
Springfield 1, Massachusetts

SPECIAL CONTROL EQUIPMENT

AJAX ELECTRIC COMPANY
940 Frankford Avenue
Philadelphia 23, Pennsylvania

ENGELHARD INDUSTRIES, INC.
113 Astor Street
Newark, New Jersey

IPSEN INDUSTRIES, INC.
715 South Main Street
Rockford, Illinois

MINNEAPOLIS-HONEYWELL
Wayne and Windrim Avenues
Philadelphia 44, Pennsylvania

TEMPERATURE CONTROLS

CLAUD S. GORDON CO.
611 West 30th Street
Chicago 16, Illinois

MINNEAPOLIS-HONEYWELL
Wayne and Windrim Avenues
Philadelphia 44, Pennsylvania

WEST INSTRUMENT CORPORATION
4363 West Montrose
Chicago 41, Illinois

TESTING EQUIPMENT

CLARK INSTRUMENT, INC.
10200 Ford Road
Dearborn, Michigan

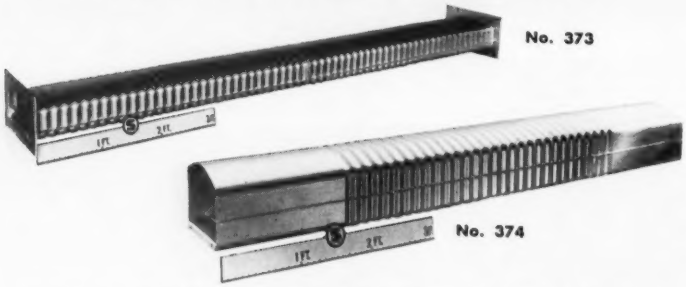
PACIFIC SCIENTIFIC COMPANY
P. O. Box 22019
Los Angeles 22, California

WILSON MECHANICAL INSTRUMENT DIV.
AMERICAN CHAIN & CABLE COMPANY, INC.
230 Park Avenue
New York 17, New York

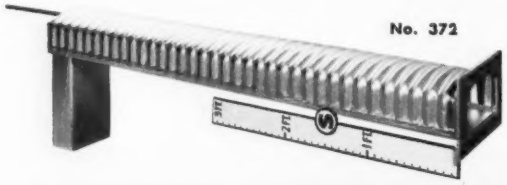
WROUGHT ALLOYS

ROLLED ALLOYS, INC.
5309 Concord Avenue
Detroit 11, Michigan

STANWOOD COR-WAL® MUFFLES
ASSURE A LONGER SERVICE LIFE!



As with stacking baskets, carburizing boxes and retorts of Cor-Wal construction, developed by Stanwood, furnace muffles of Cor-Wal construction are giving outstanding performance—a longer service life—in actual use. Cor-Wal construction provides greater, long range resistance to thermal stresses and affords better load carrying factor. Several muffle designs are shown—others also available. Send for literature.



HEAT TREATING EQUIPMENT

STANWOOD CORPORATION

4825 W. CORTLAND ST., CHICAGO 39, ILL.

For further information circle No. 86

Index To Advertisers

Advertiser	Page
Ajax Electric Company Agency—The Harry P. Bridge Company	Outside Back Cover
American Gas Furnace Company Agency—Advent Associates, Inc.	38
Ashworth Bros., Inc. Agency—Gilbraith, Hoffman & Rogers, Inc.	35
Berlin Chapman Co. Agency—R. C. Breth, Inc.	30
Bethlehem Steel Co. Agency—Hazard Advertising	5
Carborundum Company, The Agency—G. M. Basford Company	27
Cincinnati Milling Machine Co., The (Meta-Dynamics Division) Agency—The Keelor & Stites Co.	Inside Back Cover
Clark Instrument, Incorporated Agency—Don H. Jumisco, Adv. Counsel	36
Electric Furnace Co., The Agency—Henry T. Bourne Advertising Agency	29
Englehard Industries, Inc. Agency—Stuart Sande Advertising	44
General Alloys Company Agency—Roy Elliott Company	32
Heatbath Corporation Agency—Ralph Stocking Housman	43
K. H. Huppert Company Agency—Merchandising Advertisers, Inc.	44
International Nickel Company, The Agency—McCann-Marschalk Co.	10
Ipsen Industries, Inc. Agency—Wendell C. Galloway	8
Lindberg Engineering Company Agency—Don Colvin & Company, Inc.	17
Metal Treating Institute	24-25
Minneapolis-Honeywell Agency—The Aitkin-Kynett Co., Inc.	2-3
Niagara Blower Company Agency—Moss-Chase Co.	38
Pacific Scientific Co. Agency—Martin R. Klitten Co., Inc.	16
Park Chemical Company Agency—Marvin Hahn, Inc.	6
Pressed Steel Company, The Agency—Wilbur A. Myers Industrial Advertising	36
Rolled Alloys, Inc. Agency—Wainscott Advertising	35
Rolock, Inc. Agency—The Edward W. Robotham Company	41
Selas Corporation of America Agency—The Michener Co.	4
Shell Oil Company Agency—Ogilvy, Benson & Mather, Inc.	9
Stanwood Corporation Agency—Tri-State Advertising Company, Inc.	48
Sun Oil Company Agency—Erwin Wasey, Ruthrauff & Ryan, Inc.	Inside Front Cover
Waukee Engineering Company Agency—John Trytten Advertising	37
West Instrument Corporation Agency—Klau-Van Pietersom-Dunlap, Inc.	39
Wilson Mechanical Instrument Div. American Chain & Cable Co., Inc. Agency—Reincke, Meyer & Finn, Inc.	31
Wiretex Manufacturing Company, Inc. Agency—Bass & Company, Inc.	34

CINCINNATI®

ADVANCED HEAT ENGINEERING

puts non-stop surface hardening in this automated production line

Automotive shock absorber piston rods move down this transfer line at the rate of 16 hardened and finished ground parts per minute. The "in-flight" surface hardening is accomplished by a 50KW, 450KC CINCINNATI INDUCTRON® radio frequency heating machine.

As the part speeds from an initial grinding operation, simple, ingenious tooling feeds and simultaneously rotates the part through the heat coil and quench ring. Uniform surface hardness of Rc 50, 0.020" depth, is produced on part after part.

CINCINNATI INDUCTRONS are ideally suited for a wide range of production line heating applications. The power unit can be remotely located, with a compact work station positioned in the line. And Cincinnati gives you the advantage of skillfully applied work handling systems, engineered by machine tool builders having long experience in transfer line tooling.

If you employ heat as a manufacturing tool, you will benefit from Cincinnati Advanced Heat Engineering. Write direct, or discuss your requirements with a Meta-Dynamics application engineer.

This is an ALL-CINCINNATI transfer line. In addition to the Inductron indicated are loading and transfer mechanisms, plus five standard Cincinnati No. 2 Centerless Grinding Machines.

META-DYNAMICS DIVISION

CINCINNATI

THE CINCINNATI MILLING MACHINE CO.

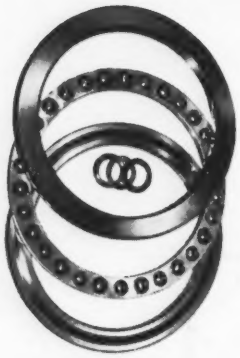
Cincinnati 9, Ohio

For further information circle No. 87

You Can't Beat an AJAX *Cataract*® Quench (ISOTHERMAL) ...for

. . . Day-in, day-out uniformity accuracy and reproducibility

. . . Freedom from cracks, distortion and surface defects



Critical hardening without distortion

Ajax isothermal heat treating reduced finish grinding 50% on these 52100 precision ball thrust bearing races by minimizing distortion and surface defects.

Taming a heat treater's "nightmare"

This 11⅜" diameter Vasco B.B. steel valve plate varies in section thickness from ½" to 1⅝". Ajax isothermal treatment hardens thin sections to Rc 63-64 and thick sections to Rc 60-64.

Automatic selective austempering

Fully automatized austempering of typewriter bars plus selective salt bath draw assures Rc 50-51 hardness at fulcrum ends and Rc 41-42 for 1" at type ends. Production was increased 65%, rejects reduced 45%.

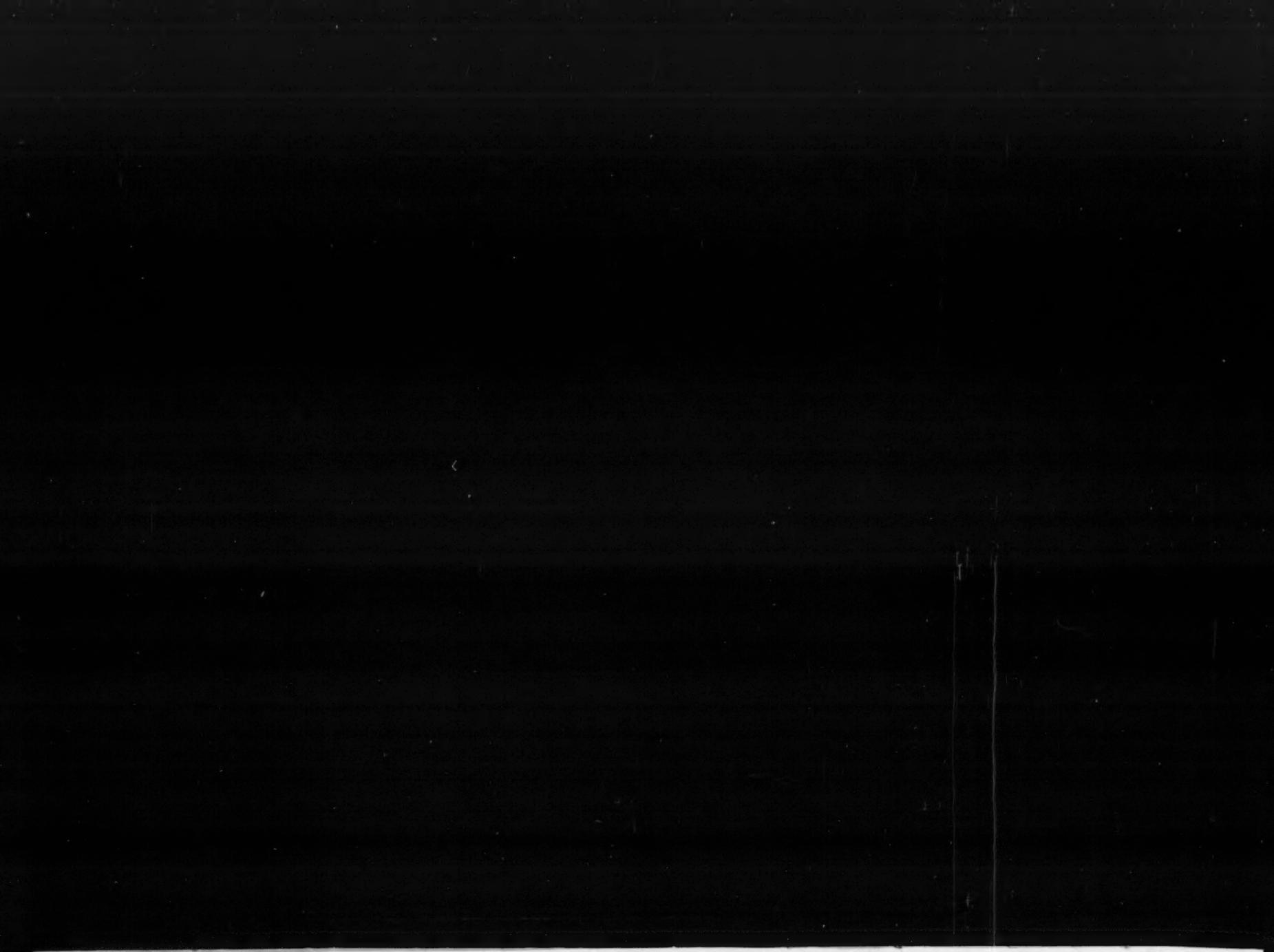
PROVIDES ANY NEEDED QUENCH VELOCITY

. . . FROM NOTHING TO NIAGARA!

Results from the Ajax Cataract Isothermal Quench are outstandingly accurate and uniform. Toughness and ductility are increased. Cracks, distortion and surface defects are virtually eliminated.

These advantages result from inherent characteristics of the method. The Cataract Quench *heats* automatically below the control point, *cools* above it. Quench direction and flow velocity are easily and effectively controlled to meet practically any requirement. Chemical balance between quenching salts and "dragged in" heating salts is automatically maintained.

Write for Ajax Bulletin 700 for details.

AJAX ELECTRIC COMPANY
940 Frankford Ave., Philadelphia 23, Pa.

For further information circle No. 88